# SALMONID DISEASE INVESTIGATIONS

## Federal Aid Project F-394-R6

George J. Schisler
Principal Investigator

and

Phil J. Schler
Eric R. Fetherman

Bruce McCloskey, Director

Job Progress Report

Colorado Division of Wildlife

Fish Research Section

Fort Collins, Colorado

June 2007

**STATE OF COLORADO**

Bill Ritter, Jr., Governor

**COLORADO DEPARTMENT OF NATURAL RESOURCES**

Harris D. Sherman, Executive Director

**COLORADO DIVISION OF WILDLIFE**

Bruce McCloskey, Director

**WILDLIFE COMMISSION**



**AQUATIC RESEARCH STAFF**

Mark S. Jones, General Professional VI, Aquatic Research Leader
Arturo Avalos, Hatchery Technician III, Research Hatchery
Stephen Brinkman, General Professional IV, F-243, Water Pollution Studies
Harry Crockett, General Professional IV, Eastern Plains Native Fishes
Patrick Martinez, General Professional V, F-242, Coldwater Reservoir Ecology & GOCO-Westslope Warmwater
R. Barry Nehring, General Professional V, F-237, Stream Fisheries Investigations
Kevin B. Rogers, General Professional IV, GOCO-Colorado Cutthroat Studies
Phil J. Schler, Hatchery Technician V, Research Hatchery
George J. Schisler, General Professional IV, F-394, Salmonid Disease Studies
Kevin Thompson, General Professional IV, F-427, Whirling Disease Habitat Interactions, GOCO-Boreal Toad Studies
Harry Vermillion, Scientific Programmer/Analyst, F-239, Aquatic Data Analysis
Nicole Vieira, Physical Scientist III, Water Quality Studies
Rosemary Black, Program Assistant I
Paula Nichols, Federal Aid Coordinator

Prepared by: ________________________________________________
George J. Schisler, GP IV, Aquatic Researcher

Approved by: ____ _______________________________________
Mark S. Jones, Aquatic Wildlife Research Leader

Date: _____________

*The results of the research investigations contained in this report represent work of the authors and may or may not have been implemented as Division of Wildlife policy by the Director or the Wildlife Commission*

## Table of Contents

## TABLES

## FIGURES

**State:** **Colorado**

**Project No.** **F-394-R6**

**Project Title: Salmonid Disease Studies:**
**Whirling Disease-Resistant Rainbow Trout Studies**

**Period Covered: July 1, 2006-June 30, 2007**

**Project Objective:** Development of rainbow trout brood stocks resistant to *M. cerebralis* for both hatchery and wild fish management applications.

**Job No. 1. Breeding and Maintenance of Whirling Disease Resistant Rainbow Trout Stocks**

**Job Objective:** Rear and maintain stocks of whirling disease resistant rainbow trout stocks.

## Hatchery Production

The whirling disease resistant rainbow trout brood stocks reared at the Fish Research Hatchery, Bellvue, CO (FRH) are unique and each requires physical isolation to avoid unintentional mixing of stocks. Extreme caution is used throughout the rearing process and during on-site spawning operations to ensure complete separation of these different brood stocks. All lots of fish are uniquely fin-clipped and some unique stocks are individually marked with Passive Integrated Transponder (PIT) tags before leaving the main hatchery. This allows for definitive identification before the fish are subsequently used for spawning.

Starting in the middle of October 2006, FRH personnel checked all of the Hofer[*] (GR) and Harrison Lake brood fish (2, 3, 4 and 5 year-olds) weekly for ripeness.

Maturation is indicated by eggs or milt flowing freely with slight pressure applied to the abdomen of the fish. The first females usually maturate two to four weeks after the first group of males. As males are identified, they are moved into a separate section of the raceway to reduce handling and fighting injuries. On November 16, 2006, the fish from the first group of GR females were ripe and ready to spawn. Before each fish was spawned, it was examined for the proper identification (fin-clip or PIT tag). This procedure was repeated each time ripe females were spawned throughout the winter.

The wet spawning method was used, where eggs from the female are stripped into a bowl along with the ovarian fluid. After collecting the eggs, milt from several males is added to the bowl. Water is poured into the bowl to activate the milt. The bowl of eggs

[*] Hofer is used interchangeably with GR throughout this document to describe the resistant strain of rainbow trout obtained in 2003 from facilities in Germany.

and milt is then covered and not disturbed for several minutes while the fertilization process takes place. The eggs are then rinsed with fresh water to expel old sperm, feces, egg shells and dead eggs. The eggs are then poured into an insulated cooler to water-harden for approximately one hour.

The water-hardened fertilized (green eggs) from all the different crosses of the GR and Harrison Lake strains were moved to the FRH main hatchery building. Extreme caution was used to keep each individual cross totally separate from all others. Upon reaching the hatchery the green eggs are tempered and then disinfected (PVP Iodine, Western Chemical Inc., Ferndale, Washington, at 100 ppm for 10 minutes at a pH of 7). Eggs were then put into vertical incubators (Heath Tray, Mari Source, Tacoma, Washington) with 5 gpm of 12.2º C (54º F) of flow-through water. The total number of eggs was calculated using number of eggs per ounce (Von Bayer trough count minus 10%) times total ounces of eggs. Separate daily egg-takes and specific individual crosses were put into separate trays and recorded. To control fungus, eggs received a prophylactic flow-through treatment of formalin (1,667 ppm for 15 minutes) every other day until eye-up.

On the 14th day in the incubator at 12.2º C (54º F), the eggs reach the eyed stage of development. The eyed eggs are removed from the trays and physically shocked to detect dead eggs, which turn white when disturbed. Dead eggs were removed (both by hand and with a Van Gaalen fish egg sorter, VMG Industries, Grand Junction, Colorado) on the 15th day. The total number of good eyed eggs was calculated using the number of eggs per ounce times total ounces. On the 16th day the eyed eggs were shipped via insulated coolers to other state agency hatcheries. The whole process was repeated throughout the spawning season with separate crosses of GR and Harrison Lake rainbow trout.

The GR and Harrison Lake rainbow trout production on-site spawn started on November 16, 2006 with ripe GR females. The last group of Harrison Lake females was spawned on February 1, 2007. With a goal in the fall to produce @ 200,000 eyed eggs, the egg take far exceeded the production needs with over 442,500 eyed eggs produced (Table 1.1). With the availability of both ripe males and females of several year classes and combinations of previous years crosses (F1 and B2) of GR and Harrison Lake strains, FRH personnel produced over 20 different lots during the spawn take. Surprisingly the overall egg quality remained quite good with 1st egg pick-off of only 26%. FRH personnel were able to fill all GR egg requests for Colorado, California, and Utah for both production and research directed projects in 2006-2007.

Table 1.1. Fish Research Hatchery on-site spawning information for GR and Harrison Lake rainbow trout strains during the winter 2006-2007 spawning season.

| STRAIN (CROSSES) | DATE SPAWNED | # OF SPAWNED FEMALES | # OF GREEN EGGS | # OF EYED EGGS | SHIPPED TO |
|---|---|---|---|---|---|
| 100% GR | 11/29/06-1/11/07 | 101 | 299,250 | 212,400 | CO and CA State Hatcheries/Research |
| 75% GR 25% Harrison Lake | 11/16/06-1/30/07 | 92 | 266,600 | 202,300 | CO and UT State Hatcheries/Research |
| 50% GR 50% Harrison Lake | 1/04/07-1/19/07 | 15 | 21,350 | 16,350 | CO Hatcheries |
| 100% Harrison Lake | 1/04/07-2/01/07 | 12 | 15,300 | 11,800 | CO Hatcheries |

## Research Projects

Eggs produced specifically for research projects comprise a large proportion of the total production from the FRH. Specific details of those individual crosses and families created for the laboratory and field experiments are described in their respective sections of this report. The bulk of these family group descriptions appear in the following section, Job 2: Whirling Disease Resistance Laboratory Experiments.

**Job No. 2: Whirling Disease Resistance Laboratory Experiments**

**Job Objective:** Evaluate the inheritability and stability of whirling disease resistance in selected strains of rainbow trout.

**Experiment 1: Inheritance of *Myxobolus cerebralis* resistance among second generation crosses of the Hofer (GR) and Colorado River (CRR) rainbow trout strains.**

## INTRODUCTION

The Hofer (GR) rainbow trout strain has been identified as more resistant to whirling disease than other rainbow trout strains when exposed to *Myxobolus cerebralis* in laboratory conditions (Hedrick et al. 2003). However, the survival and viability of the strain in the wild is questionable and the consequences of stocking the strain directly into wild trout waters is unknown (Schisler et al. 2006). In 2004, a study was conducted in which GR strain rainbow trout and Colorado River rainbow (CRR) strain rainbow trout were crossed. The principle aim of that project was to incorporate whirling disease resistance from the GR into the CRR strain, a strain that is typically used to establish wild rainbow trout populations in Colorado (Schisler et al. 2006). Results of exposure experiments with the GR-CRR (50:50) cross (F1 generation) showed that spore counts per fish were reduced significantly from those found in the pure CRR strain. While average infection severity in the first generation cross was much lower than the pure CRR strain, it was not reduced to the spore count levels of the pure GR strain. However, some families, created from individual male-female pairs, were more resistant than others. In addition, many individual fish from those crosses appeared to inherit a similar level of resistance as observed in the pure GR strain. A second exposure experiment was initiated to evaluate the performance of the pure GR, pure CRR, F1 generation, and a second generation GR-CRR (25:75) backcross (defined as the B2 generation) in the presence of the whirling disease parasite. This experiment would provide insight to the continued inheritability of resistance to *M. cerebralis*, particularly in F1 generation fish back-crossed with the wild CRR strain.

## METHODS

Spawning of all families occurred at the Colorado Division of Wildlife Fish Research Hatchery (FRH) and Colorado Cooperative Fish and Wildlife Unit (COOP) wet lab from mid-November 2005 through the end of December 2006 (Tables 2.1 and 2.2). Both male and female pure GR and F1 fish are held on site. F1 individuals had been tagged with Passive Integrated Transponder (PIT) tags to identify them by family group. Only the lowest spore count families of the F1 variety were retained for this second generation of crosses. These fish were identified by their 10 digit alpha numeric code prior to spawning. All tagged or untagged individuals were also numbered in the order that they were spawned. Pure CRR individuals were held at the Colorado Division of

Wildlife Glenwood Springs Hatchery (GWSH). Males were spawned at the GWSH and their sperm was transported in individual, numbered containers back to the FRH for fertilization of the GR and F1 eggs. In addition, live male and female CRR rainbow trout were transported back to the FRH and spawned with each other as well as GR and F1 males. An anal fin clip was taken from each spawned individual and stored in 70% ETOH for later genetic analysis. Eggs were placed in incubators at the FRH or COOP wet lab and held until they were eyed. Once eyed, eggs were placed in 76 liter (20 gallon) tanks containing short (7 cm) standpipes for a greater amount of water turnover at the COOP wet lab, where they were hatched.

Individual families (single male/female matings) were used as replicates in this experiment. Three pure GR families, three pure CRR families, 10 F1 families, and 16 B2 families were used in this evaluation. In some cases, up to 2,000 fertilized eggs are produced with each paired cross. For the purposes of this exposure experiment, fish were culled down to approximately 50 per family until immediately before exposure. At that time the families were then reduced to 30 fish each.

Table 2.1. Family groups created for *M. cerebralis* resistance laboratory testing (FRH brood) during spring 2006 spawning season.

| Group | Female | Male | Fertilized | Female Origin | Male Origin | Hatched | Dosed | Lab Experiment | Other Destinations |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 135113115a | 134959197a | 11/22/2005 | HoferxHarrison (54) (04 EXP) | Hofer (56) (04 EXP) | 12/19/2005 | 2/17/2005 | E9 | Utah 12,992 eggs 12-13-05 |
| 2 | 133754663a | 134839090a | 11/22/2005 | Hofer (13) (04 EXP) | HoferxHarrison (48) (04 EXP) | 12/19/2005 | 2/17/2005 | E8 | " " |
| 3 | 133754663a | 134661691a | 11/22/2005 | Hofer (13) (04 EXP) | Hofer (15) (04 EXP) | 12/19/2005 | 2/17/2005 | E7 | " " |
| 4 | 133957366a | 134609145a | 11/22/2005 | Hofer (14) (04 EXP) | HoferxHarrison (53) (04 EXP) | 12/19/2005 | 2/17/2005 | E6 | " " |
| 5 | 133957366a | 133557283a | 11/22/2005 | Hofer (14) (04 EXP) | HoferxHarrison (53) (04 EXP) | 12/19/2005 | 2/17/2005 | E4 | " " |
| 6 | New Clip # 1 | 133665491a | 11/22/2005 | Hofer 4-yr old | HoferxHarrison (46) (04 EXP) | 12/19/2005 | 2/17/2005 | E3 | " " |
| 7 | New Clip # 2 | 133779472a | 11/22/2005 | Hofer 4-yr old | HoferxHarrison (46) (04 EXP) | 12/19/2005 | 2/17/2005 | E24 | " " |
| 8 | New Clip # 3 | 133827615a | 11/22/2005 | Hofer 4-yr old | HoferxHarrison (46) (04 EXP) | . | . | - | " " and Research brood |
| 9 | New Clip # 4 | 133966134a | 11/22/2005 | Hofer 4-yr old | HoferxHarrison (54) (04 EXP) | . | . | - | " " and Research brood |
| 10 | New Clip # 5 | 133966134a | 11/22/2005 | Hofer 4-yr old | HoferxHarrison (54) (04 EXP) | . | . | - | " " and Research brood |
| 11 | New Clip # 5 | adipose clip male | 11/22/2005 | Hofer 4-yr old | Hofer 4-yr old | 12/19/2005 | 2/17/2005 | E20 | |
| | | | | | | | | | |
| 12 | 134963680a | 134931211a | 11/30/2005 | Hofer (13) (04 EXP) | HoferxHarrison (48) (04 EXP) | . | . | - | Utah 2,508 eggs 12-13-05 |
| 13 | 134929766a | 133817266a | 11/30/2005 | HoferxHarrison (54) (04 EXP) | Hofer (16) (04 EXP) | . | . | - | and Research Brood |
| | | | | | | | | | |
| 14 | 134522140a | CRR-24 | 12/1/2005 | CRRxHofer (35) (04 EXP) | Glenwood-CRR | 1/3/2005 | 3/7/2006 | E2 | Gunnison River plant ? |
| 15 | 133735465a | CRR-22 | 12/1/2005 | CRRxHofer (25) (04 EXP) | Glenwood-CRR | 1/3/2005 | 3/7/2006 | E10, P 1 (UCDAVIS) | |
| 16 | 134512313a | CRR-19 | 12/1/2005 | CRRxHofer (32) (04 EXP) | Glenwood-CRR | 1/3/2005 | 3/7/2006 | E12, P 2 (UCDAVIS) | |
| 17 | 134836296a | CRR-21 | 12/1/2005 | CRRxHofer (36) (04 EXP) | Glenwood-CRR | . | . | - | |
| 18 | 133661673a | CRR-23 | 12/1/2005 | CRRxHofer (25) (04 EXP) | Glenwood-CRR | 1/3/2005 | 3/7/2006 | E17, P 3 (UCDAVIS) | |
| 19 | 134835230a | CRR-20 | 12/1/2005 | CRRxHofer (43) (04 EXP) | Glenwood-CRR | 1/3/2005 | 3/7/2006 | E18, P 4 (UCDAVIS) | |
| 20 | 133662650a | CRR-4 | 12/1/2005 | CRRxHofer (31) (04 EXP) | Glenwood-CRR | 1/3/2005 | 3/7/2006 | E19, P 5 (UCDAVIS) | |
| 21 | 134919273a | CRR-8 | 12/1/2005 | CRRxHofer (36) (04 EXP) | Glenwood-CRR | . | . | - | |
| | | | | | | | | | |
| 22 | 134963295a | Nclip # 3 | 12/20/2005 | HoferxCRR (28) (04 EXP) | Glenwood-CRR | . | . | - | Yampa River 2,000 5-26-06 |
| 23 | 134616152a | Nclip # 2 | 12/20/2005 | HoferxCRR (27) (04 EXP) | Glenwood-CRR | 1/18/2005 | 3/21/2005 | E22 | Sarvice Creek |
| 24 | 133957222a | Nclip # 4 | 12/20/2005 | HoferxCRR (11) (04 EXP) | Glenwood-CRR | . | . | - | and Yampa River 5,500 5-31-06 |
| 25 | 134961627a | Nclip # 5 | 12/20/2005 | HoferxCRR (31) (04 EXP) | Glenwood-CRR | 1/18/2005 | 3/21/2005 | E25, W1 (UCDAVIS) | Fryingpan River 4,430 5-17-06 |
| 26 | 133773235a | Nclip # 6 | 12/20/2005 | HoferxCRR (2) (04 EXP) | Glenwood-CRR | 1/18/2005 | 3/21/2005 | W2 (UCDAVIS) | " " |
| 27 | 133961091a | Nclip # 7 | 12/20/2005 | HoferxCRR (31) (04 EXP) | Glenwood-CRR | . | . | - | " " |
| 28 | 133877734a | Nclip # 8 | 12/20/2005 | HoferxCRR (26) (04 EXP) | Glenwood-CRR | 1/18/2005 | 3/21/2005 | W5 | " " |
| 29 | 133661243a | Nclip # 9 | 12/20/2005 | HoferxCRR (32) (04 EXP) | Glenwood-CRR | 1/18/2005 | 3/21/2005 | W6 | " " |
| 30 | 133672213a | Nclip # 10 | 12/20/2005 | HoferxCRR (26) (04 EXP) | Glenwood-CRR | 1/18/2005 | 3/21/2005 | W7, W3 (UCDAVIS) | " " |
| 31 | 133723393a | Nclip # 11 | 12/20/2005 | HoferxCRR (1) (04 EXP) | Glenwood-CRR | 1/18/2005 | 3/21/2005 | W8, E1 (UCDAVIS) | " " |
| 32 | 134546717a | Nclip # 12 | 12/20/2005 | HoferxCRR (31) (04 EXP) | Glenwood-CRR | . | . | - | " " |
| 33 | 133764625a | Nclip # 13 | 12/20/2005 | HoferxCRR (2) (04 EXP) | Glenwood-CRR | 1/18/2005 | 3/21/2005 | W9, W4 and P 6 (UCDAVIS) | " " |
| 34 | 134519513a | Nclip # 14 | 12/20/2005 | HoferxCRR (1) (04 EXP) | Glenwood-CRR | 1/18/2005 | 3/21/2005 | W10 | " " |
| 35 | 134511753a | Nclip # 15 | 12/20/2005 | HoferxCRR (30) (04 EXP) | Glenwood-CRR | 1/18/2005 | 3/21/2005 | W11 | " " |
| | | | | | | . | . | | |
| 36 | Clip 36 | Nclip # 16 | 12/21/2005 | Hofer 4-yr old | Glenwood-CRR | 1/18/2005 | 3/21/2005 | W12 | Rio Grande, 8,109 |
| 37 | Clip 37 | Nclip # 26 | 12/21/2005 | Hofer 4-yr old | Glenwood-CRR | 1/18/2005 | 3/21/2005 | W13 | and Beaver Creek, 5,326 4-20-06 |
| 38 | Clip 38 | Nclip # 18 | 12/21/2005 | Hofer 4-yr old | Glenwood-CRR | 1/18/2005 | 3/21/2005 | W14 | " " |
| 39 | Clip 39 | Nclip # 19 | 12/21/2005 | Hofer 4-yr old | Glenwood-CRR | 1/18/2005 | 3/21/2005 | W15 | " " |
| 40 | Clip 40 | Nclip # 20 | 12/21/2005 | Hofer 4-yr old | Glenwood-CRR | 1/18/2005 | 3/21/2005 | W16 | " " |
| 41 | Clip 41 | Nclip # 21 | 12/21/2005 | Hofer 4-yr old | Glenwood-CRR | 1/18/2005 | 3/21/2005 | W17 | " " |
| 42 | Clip 42 | Nclip # 22 | 12/21/2005 | Hofer 4-yr old | Glenwood-CRR | 1/18/2005 | 3/21/2005 | W18 | " " |

Table 2.2. Family groups created for *M. cerebralis* resistance laboratory testing (COOP wet lab brood) during spring 2006 spawning season.

| Group | Female | Male | Fertilized | Descripton | Female Origin | Male Origin | Location of eggs | Hatched | Dosed |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | |
| Tray 1 Round | 134656324a | 134418440a | 11/14/2005 | | Hofer (56) (04 EXP) | Hofer (13) (04 EXP) | Quonset | . | . |
| Tray 1 | 134569323a | 133656755a | 11/14/2005 | | Hofer (15) (04 EXP) | Hofer (14) (04 EXP) | Quonset | 12/19/2005 | 2/17/2005 |
| Tray 2 Round | 134709452a | 134764757a | 11/14/2005 | | Hofer (14) (04 EXP) | Hofer (15) (04 EXP) | Quonset | . | . |
| Tray 2 | 134953225a | 133615593a | 11/14/2005 | | Hofer (13) (04 EXP) | Hofer (14) (04 EXP) | Quonset | . | . |
| Tray 3 Round | 133553517a | 134454273a | 11/14/2005 | | Hofer (15) (04 EXP) | Hofer (14) (04 EXP) | Quonset | . | . |
| Tray 3 | 133551220a | 133833555a | 11/14/2005 | | HoferxHarrison (46) (04 EXP) | HoferxHarrison (55) (04 EXP) | Quonset | . | . |
| Tray 4 Round | 133551220a | 134418440a | 11/14/2005 | | HoferxHarrison (46) (04 EXP) | Hofer (13) (04 EXP) | Quonset | . | . |
| Tray 4 | 134616580a | 133529345a | 11/14/2005 | | HoferxHarrison (48) (04 EXP) | HoferxHarrison (54) (04 EXP) | Quonset | 12/19/2005 | 2/17/2005 |
| Tray 5 Round | 135131196a | 134424717a | 11/14/2005 | | HoferxHarrison (48) (04 EXP) | HoferxHarrison (46) (04 EXP) | Quonset | . | . |
| Tray 5 | 134616580a | 134418440a | 11/14/2005 | | HoferxHarrison (48) (04 EXP) | Hofer (13) (04 EXP) | Quonset | 12/27/2005 | 2/24/2005 |
| Tray 6 Round | 133557615a | 133533244a | 11/14/2005 | | Hofer (13) (04 EXP) | HoferxHarrison (53) (04 EXP) | Quonset | . | . |
| Tray 6 | 133557615a | 133729211a | 11/14/2005 | | Hofer (13) (04 EXP) | HoferxHarrison (26) (04 EXP) | Quonset | . | . |
| Tray 7 Round | 134871655a | 133914593a | 11/14/2005 | | Hofer (14) (04 EXP) | HoferxHarrison (53) (04 EXP) | Quonset | . | . |
| Tray 7 | 134871655a | 134619383a | 11/14/2005 | | Hofer (14) (04 EXP) | HoferxHarrison (48) (04 EXP) | Quonset | . | . |
| | | | | | | | | . | . |
| | | | | | | | | . | . |
| Elab Tank 12 | 133956316a | Clip #6 | 12/1/2005 | low x | HoferxCRR (30) (04 EXP) | Glenwood-CRR | Quonset | . | . |
| Elab Tank 13 | 134877377a | Clip #9 | 12/1/2005 | med x | HoferxCRR (37) (04 EXP) | Glenwood-CRR | Quonset | . | . |
| Elab Tank 17 | 133749392a | Clip #12 | 12/1/2005 | low | HoferxCRR (24) (04 EXP) | Glenwood-CRR | Quonset | . | . |
| Elab Tank 18 | 133532116a | Clip #18 | 12/1/2005 | med | HoferxCRR (33) (04 EXP) | Glenwood-CRR | Quonset | . | . |
| Elab Tank 19 | 133961134a | Clip #17 | 12/1/2005 | med | HoferxCRR (20) (04 EXP) | Glenwood-CRR | Quonset | . | . |
| Elab Tank 21 | 133533450a | Clip #11 | 12/1/2005 | low x | HoferxCRR (32) (04 EXP) | Glenwood-CRR | Quonset | 12/27/2005 | 2/24/2005 |
| Elab Tank 22 | 133962653a | Clip #2 | 12/1/2005 | low | HoferxCRR (36) (04 EXP) | Glenwood-CRR | Quonset | . | . |
| Elab Tank 23 | 133547327a | Clip # 13 | 12/1/2005 | high x | HoferxCRR (9) (04 EXP) | Glenwood-CRR | Quonset | . | . |
| Elab Tank 25 | 133745327a | Clip # 7 | 12/1/2005 | low | HoferxCRR (31) (04 EXP) | Glenwood-CRR | Quonset | 12/27/2005 | 2/24/2005 |
| Elab Tank 26 | 133533466a | Clip #10 | 12/1/2005 | med | HoferxCRR (2) (04 EXP) | Glenwood-CRR | Quonset | . | . |
| | | | | | | | | | |
| CRR (G1) | . | . | . | | Glenwood-CRR | Glenwood-CRR | Quonset | 1/1/2006 | 3/7/2006 |
| CRR (G2) | . | . | . | | Glenwood-CRR | Glenwood-CRR | Quonset | 1/1/2006 | 3/7/2006 |
| CRR (G3) | . | . | . | | Glenwood-CRR | Glenwood-CRR | Quonset | 1/1/2006 | 3/7/2006 |

Fish from each group were exposed to an average of 2,000 triactinomyxons per fish as two-month old fry. The fish were reared for five months post-exposure. Fish were fed a maintenance diet (Rangen trout feed, Rangen Inc., Buhl, Idaho) of roughly 2% body weight per day. Mortalities were removed and recorded daily. At the conclusion of the experiment, 10 fish were randomly selected from each family. The fish were measured and weighed, physical deformities were recorded, and heads were processed to enumerate myxospores per fish with the PTD (pepsin-trypsin digest) method.

Length, weight, and myxospore results were compared between strains using Proc GLM in SAS system software. If significant differences were observed, Tukey's Studentized Range (HSD) test was used to determine which strains differed from each other. Alpha was set at 0.05 for all tests.

## RESULTS

The GR rainbow trout developed the lowest spore counts of the groups tested, averaging 1,482 spores per fish (Figure 2.1). The CRR families developed the highest spore counts, averaging 232,973 spores per fish. The F1 families averaged 47,128 spores per fish. These results were similar to those found in the prior experiment. The B2 families developed higher spore counts, averaging 125,168 spores per fish. The statistical tests indicated that the CRR strain had significantly higher spore counts than the GR, F1 and B2 strains. The B2 strain had significantly higher spore counts than the GR strain, but not significantly higher than the F1 strain. The spore counts in the GR and F1 strains were not significantly different from each other. The GR, B2 and F1 strains averaged 15.3, 12.7, and 10.9 grams, respectively, at the end of the experiment. The pure CRR strain weighed significantly less than the GR strain at 7.7 grams. The pure CRR strain grew to an average of 87.3 mm, which was significantly shorter than the pure GR, B2, and F1 strains at 113.5, 108.4, and 105.5 mm, respectively.

## DISCUSSION

In both the 2004 exposure experiment (Schisler et al. 2006) and this experiment, the F1 generation exhibited noticeable variation in spore counts and physical deformities between families. Within family variation in infection severity was relatively low. In this experiment, the B2 generation exhibited much more within family variation in infection severity (Figure 2.2). This is due to the re-assortment of genes and loss of resistance in some individual offspring of the B2 generation, but not of others. Only individuals inheriting resistance to whirling disease will be successful with regard to survival and reproductive potential in areas where the parasite has eliminated pure CRR populations. The rapid loss of resistance to *M. cerebralis* in subsequent generations of back-crosses in a hatchery setting could result in selection pressures that do not attain the goal of wild-strain fish with resistance to the parasite. Space constraints also limit the scope of this type of intensive selection in an artificial setting. An alternative to selecting families in a fish culture facility is to allow the selection among first generation crosses to occur in the wild. The selection pressure for individuals with both wild characteristics and resistance to *M. cerebralis* is immediate in locations where the parasite is endemic.

Relatively good survival has been observed in first generation crosses in the wild (See Job 4, Whirling Disease Resistant Wild Strain Brood Stock Development and Evaluation). Therefore, it may be unnecessary to continue backcrossing F1 or B2 strains with pure CRR to ensure survival in the wild.

The level of resistance in the families and individuals created in this experiment were compared with the previous generation of crosses. Genetic samples were collected from every individual used as parents in these lineages, and all of the offspring evaluated for resistance in these experiments. Comparison of the resistance in these fish with the genetic profiles of multiple families and individuals will help identify markers for resistance. Future research will investigate the continued heritability of whirling disease resistance, as well as physiological performance and survival of these crosses in the wild.

Figure 2.1. Average spore counts for the three Hofer (GR), three Colorado River rainbow (CRR), ten F1 [GR-CRR (50:50)] and 16 B2 [GR-CRR (25:75)] strains. Each point represents average spore counts for each individual family.

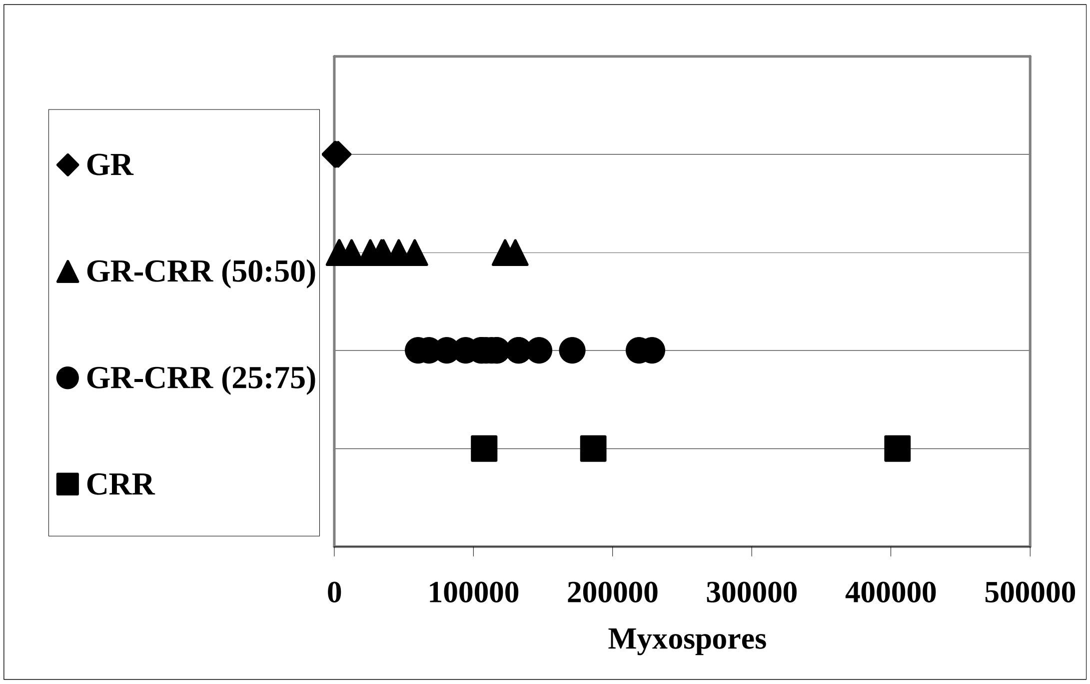
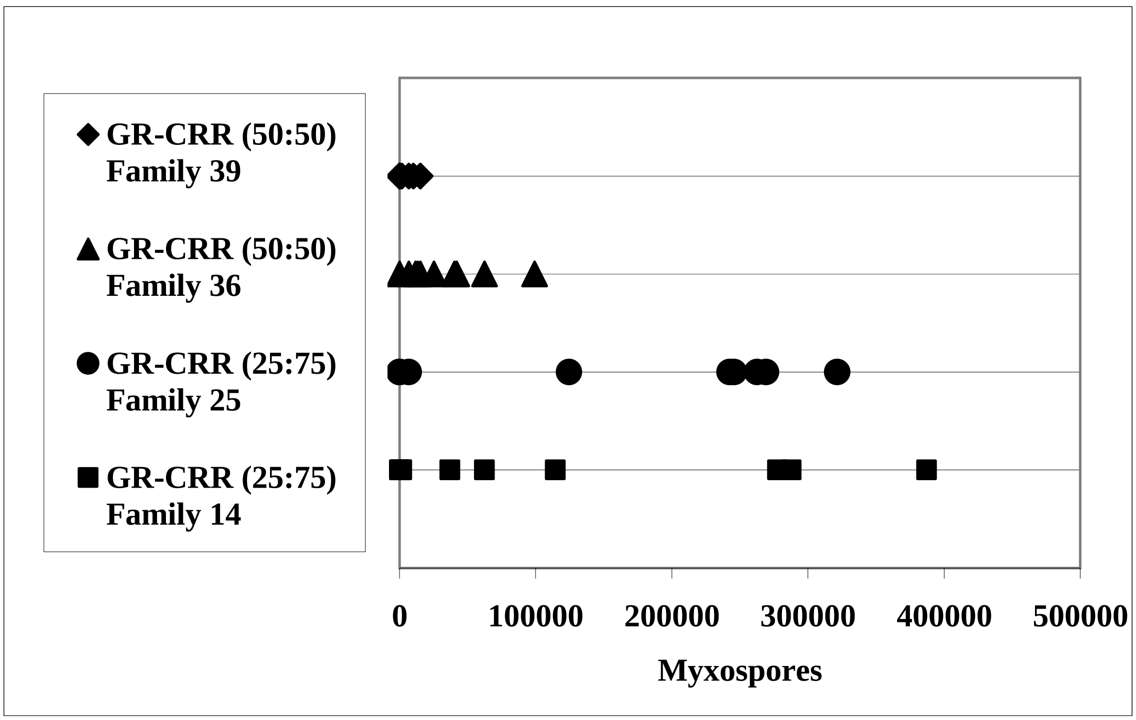


Figure 2.2. Example of inter-family variability in infection severity. Spore counts for two F1 [GR-CRR (50:50)] families and two B2 [GR-CRR (25:75)] families are shown. Ten fish per family were sampled. In this graph each point represents spore counts for each individual fish. Note that the B2 families show a large range of variation, from 0 to almost 400,000 spores, whereas the F1 families show a smaller range of variation, from 0 to only about 100,000 spores.



## References

Hedrick, R. P., T. S. McDowell, G. D. Marty, G. T. Fosgate, K. Mukkatira, K. Myklebust, and M. El Matbouli. 2003. Susceptibility of two strains of rainbow trout (one with suspected resistance to whirling disease) to *Myxobolus cerebralis* infection. Diseases of Aquatic Organisms 55:37-44.

Schisler, G. J. 2006. Salmonid Disease Studies. Federal Aid in Fish and Wildlife Restoration, Job Progress Report. Colorado Division of Wildlife, Fish Research Section. Fort Collins, Colorado.

Schisler, G. J., K. A. Myklebust, and R. P. Hedrick. 2006. Inheritance of *Myxobolus cerebralis* resistance among F1-generation crosses of whirling disease resistant and susceptible rainbow trout strains. Journal of Aquatic Animal Health 18:109-115.

**Experiment 2: Physiological characteristics and inheritance of *Myxobolus cerebralis* resistance among multiple generational crosses of the Hofer (GR) and Colorado River (CRR) rainbow trout strains.**

## INTRODUCTION

A laboratory experiment is currently being conducted at the Colorado Cooperative Fish and Wildlife Research Unit (COOP) wet lab in Fort Collins, Colorado to test the resistance of the German “Hofer” rainbow (GR) and Colorado River (CRR) rainbow trout strains, and crosses of these strains, to whirling disease. CRRs have historically been used for stocking in Colorado and they retain many of the desired wild rainbow trout characteristics needed to survive in Colorado’s rivers and streams. The CRR strain is, unfortunately, highly susceptible to whirling disease and their populations have experienced dramatic declines over the past decade. The GR strain has demonstrated very strong resistance to whirling disease in past exposure experiments. However, because the GR strain is a highly domesticated food fish, their survival and viability in the wild is uncertain. Also, the consequences of stocking this strain directly into the wild are unknown. In 2003, a breeding program was established to examine various crosses between the GR and CRR trout strains, with the ultimate goal of identifying those crosses that have the correct combination of resistant rainbow trout characteristics and wild rainbow trout characteristics to survive and reproduce in the wild in areas where heavy *Myxobolus cerebralis* infection exists.

The resistance of two of these crosses, F1s and B2s, has been examined in previous exposure experiments (see previous section). F1s are the first filial generation cross between a pure GR individual and a pure CRR individual. B2s are the second generation backcross between an F1 individual and a pure CRR individual. These crosses were included in this exposure experiment to gain more knowledge about their inherited resistance to whirling disease. In addition, a third cross was included in this experiment to gain a better understanding of how resistant trout characteristics and wild trout characteristics are inherited in subsequent generations. This third cross is defined as true F2s, which are the second filial generation forward cross between two F1 individuals.

The ultimate goal of this laboratory experiment is to further evaluate the resistance of the GR and CRR trout strains and their crosses to whirling disease, and to evaluate other characteristics that may play an important role in their survival in the wild including swimming performance and predator avoidance. Growth and feed efficiencies were also very closely monitored in this experiment.

## METHODS

Spawning of all families occurred at the Colorado Division of Wildlife Fish Research Hatchery (FRH) from mid-November 2006 through the end of January 2007. As in the previous experiment, both male and female pure GR and F1 fish are held on site and pure CRR individuals are obtained from the Colorado Division of Wildlife Glenwood Springs Hatchery (GWSH). F1 individuals, tagged with Passive Integrated Transponder (PIT) tags, were identified by their 10 digit alpha numeric code (Table 2.1). An anal fin clip was taken from each spawned individual for later genetic analysis. Eggs were placed in incubators at the FRH or COOP wet lab and held until they were eyed (Table 2.1). Once eyed, picked eggs were placed in 20 gallon (76 liter) tanks containing short (7 cm) standpipes for a greater amount of water turnover at the COOP wet lab, where they were hatched.

Upon swim-up, tall (30 cm) standpipes were placed in the tanks and the fish were started on size 0 trout diet. After approximately 335 degree days (ºC), fish were fed size 1 trout diet (Table 2.3). At this time, families were reduced to 50 fish per family. This was considered the beginning of the growth experiment. Each family was batch weighed and fed 4% of the total fish weight. Families were maintained at 50 fish until the day before infection in order to account for any mortality that may have occurred as a result of the switch to a larger feed size. An additional 50 fish from four of the families from each strain were removed and placed in uninfected control tanks (Table 2.2). At the time of infection, families were reduced to 25 fish. Again, fish were batch weighed and fed 4% of the total fish weight (Table 2.3). Control families were also reduced to 25 fish at this time. Fish were reweighed every two weeks and feed amount was changed accordingly. Fish were switched to size 2 trout diet at a batch weight of 75 grams, size 3 trout diet at a batch weight of 162.5 grams, and size 4 trout diet at a batch weight of 500 grams, according to hatchery trout feed guidelines (Tables 2.4 and 2.5).

Fish were infected at an average of 678 degree days (ºC) post-hatch (Table 2.1). Triactinomyxons (TAMs) for exposures beginning on February 15, 2007 and continuing through April 20, 2007 originated at Ron Hedrick's lab at U.C. Davis. TAMs for exposures after April 20, 2007 came from Barry Nehring with the Colorado Division of Wildlife in Montrose, Colorado. Cultures of TAMs in both cases were produced from Mt. Whitney *Tubifex tubifex* worms. TAMs were counted by mixing 1,000 µl of filtrate containing the TAMs and 60 µl of crystal violet used to dye the TAMs to make them easier to see; 84.6 µl of this mixture was then placed on a slide and TAMs per slide were counted. Ten counts were conducted on the filtrates prior to exposures to increase confidence in estimates of TAM concentrations in the filtrate. An average of the counts was taken, and this number was used to calculate the amount of TAMs per ml. Fish were infected with 2,000 TAMs per individual, a total of 50,000 TAMs per tank. Before exposure, the water flow to each aquarium was halted and each aquarium received copious aeration with an air stone to ensure full mixing of the TAMs and equal exposure of all fish. The approximate amount of filtrate to deliver 2,000 TAMs per fish was measured out, placed in a 1,000 ml beaker, and evenly distributed throughout each aquarium. This was done in two passes to ensure equal distribution of TAMs in the tank and to account for a possible unequal distribution of TAMs within the filtrate. Water flow was halted for one hour to ensure complete infection of all fish.

Swimming experiments began on April 9, 2007. Five fish were randomly chosen from four randomly chosen families of each strain to be swum at two weeks, one month, and two and a half months post-exposure in two Loligo® swimming flumes. Fish were marked before being swam with Northwest Marine Technologies fluorescent visual implant elastomer (VIE) tags so that the same fish could be swam at all three dates. After a fish was placed in the flume, it was run at the lowest speed of 2 cm/s for one hour. This allowed the fish to acclimate to the flume and recover from handling. After the one hour acclimation period, the flume speed was increased to 5 cm/s for ten minutes. Flume speed continued to be increased by 5 cm/s every ten minutes until the fish reached its critical swimming velocity (CSV). The fish was considered to have reached its CSV when it was no longer swimming against the current and was pushed up against the screen at the back of the flume. The fish was then removed from the flume, measured and weighed, and allowed to recover in an aerated bucket held at the same temperature as the flume. A total of 535 fish will be swum over the course of this experiment. The goal of the swimming experiment is determine differences in CSVs between the strains, and to determine whether there is a difference in swimming ability between infected and non-infected fish within a strain. Swimming experiments will continue through mid-August 2007.

The exposure experiment will conclude once the fish have reached approximately 2,000 degree days (ºC) post-exposure, which is approximately five months post-exposure. Ten fish will be randomly removed from each tank, measured and weighed. The head of each individual will then be removed and cut in half from the nose to the back of the head. Half of the head will be used for histological analysis, and the other half will be used to determine spore load using pepsin tripsin digest (PTD) testing. In addition, the body of each individual will be kept and used to determine an average total lipid count for each strain. Following the conclusion of the exposure experiment, behavioral experiments will also be conducted using the remainder of the fish in each family. The goal of the behavior experiment is to determine the ability of a strain, as well as infected and non-infected fish within a strain, to detect and avoid predators.

Table 2.3. Family groups created for *M. cerebralis* resistance experiment conducted at the Colorado Cooperative Fish and Wildlife Unit (COOP) wet lab in 2006-2007.

| Group | Strain | Male | Female | Male Origin | Female Origin | Spawn Date | Location of Eggs | Status | Hatched | Dosed | Number | Degree Days | Tank |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| RH15 | B2 (CRR♂ x F1♀) | M15 | F3 - 133653755A | GWSH | Group 35 | 12/12/2006 | FRH | Original | 1/9/2007 | 3/21/2007 | 25 | 629.30 | 40 |
| RH16 | B2 (CRR♂ x F1♀) | M17 | F10 - 133957222A | GWSH | Group 11 | 12/12/2006 | FRH | Original | 1/9/2007 | 3/13/2007 | 25 | 661.50 | 63 |
| RH17 | B2 (CRR♂ x F1♀) | M18 | F11 - 133661673A | GWSH | Group 25 | 12/12/2006 | FRH | Original | 1/9/2007 | 3/21/2007 | 25 | 629.30 | 3 |
| RH18 | B2 (CRR♂ x F1♀) | M19 | F12 - 134919273A | GWSH | Group 36 | 12/12/2006 | FRH | Original | 1/9/2007 | 3/21/2007 | 25 | 629.30 | 16 |
| RH19 | B2 (CRR♂ x F1♀) | M20 | F4 - 134836296A | GWSH | Group 36 | 12/12/2006 | FRH | Original | Dead as eggs | | | | |
| RH20 | B2 (CRR♂ x F1♀) | M21 | F2 - 134521446A | GWSH | Group 11 | 12/12/2006 | FRH | Original | 1/9/2007 | 3/13/2007 | 25 | 661.50 | 55 |
| RH37 | B2 (CRR♂ x F1♀) | M37 | F29 - 133662650A | GWSH | Group 31 | 12/28/2006 | FRH | Original | 1/27/2007 | 4/3/2007 | 25 | 718.00 | 66 |
| RH39 | B2 (CRR♂ x F1♀) | M38 | F30 - 133723393A | GWSH | Group 1 | 12/28/2006 | FRH | Original | 1/27/2007 | 4/6/2007 | 25 | 677.90 | 30 |
| RH41 | B2 (CRR♂ x F1♀) | M39 | F31 - 134546717A | GWSH | Group 31 | 12/28/2006 | FRH | Original | 1/27/2007 | 4/6/2007 | 25 | 677.90 | 32 |
| RH43 | B2 (CRR♂ x F1♀) | M40 | F32 - 134519513A | GWSH | Group 1 | 12/28/2006 | FRH | Original | 1/27/2007 | 4/6/2007 | 25 | 677.90 | 41 |
| RH48 | B2 (CRR♂ x F1♀) | M48 | F36 - 134616152A | GWSH | Group 27 | 1/11/2007 | FRH | Replaced RH19 | 2/8/2007 | 4/13/2007 | 25 | 668.3 | 68 |
| QT71 | B2 (F1♂ x CRR♀) | M31 - 133752472A | F53 | Group 43 | GWSH | 1/17/2007 | COOP | Original | 3/6/2007 | 5/4/2007 | 25 | 616.20 | 71 |
| QT72 | B2 (F1♂ x CRR♀) | M45 - 135126471A | F54 | Group 1 | GWSH | 1/17/2007 | COOP | Original | 3/13/2007 | 5/25/2007 | 25 | 716.80 | 8 |
| QT73 | B2 (F1♂ x CRR♀) | M13 - 133648333A | F49 | Group 35 | GWSH | 1/17/2007 | COOP | Original | 3/6/2007 | 5/4/2007 | 25 | 616.20 | 76 |
| QT74 | B2 (F1♂ x CRR♀) | M1 - 133874590A | F48 | Group 30 | GWSH | 1/17/2007 | COOP | Original | 3/15/2007 | 5/29/2007 | 25 | 754.20 | 35 |
| QT75 | B2 (F1♂ x CRR♀) | M3 - 134567394A | F52 | Group 35 | GWSH | 1/17/2007 | COOP | Original | 3/6/2007 | 5/4/2007 | 25 | 616.20 | 74 |
| QT76 | B2 (F1♂ x CRR♀) | M43 - 134746323A | F50 | Group 11 | GWSH | 1/17/2007 | COOP | Original | 3/13/2007 | 5/25/2007 | 25 | 716.80 | 36 |
| QT77 | B2 (F1♂ x CRR♀) | M42 - 134961377A | F47 | Group 30 | GWSH | 1/17/2007 | COOP | Original | 3/7/2007 | 5/8/2007 | 25 | 646.70 | 79 |
| QT78 | B2 (F1♂ x CRR♀) | M5 - 133669695A | F45 | Group 11 | GWSH | 1/17/2007 | COOP | Original | 3/5/2007 | 5/4/2007 | 25 | 626.50 | 57 |
| QT79 | B2 (F1♂ x CRR♀) | M41 - 134936464A | F46 | Group 30 | GWSH | 1/17/2007 | COOP | Original | 3/6/2007 | 5/4/2007 | 25 | 616.20 | 69 |
| QT80 | B2 (F1♂ x CRR♀) | M14 - 134921616A | F44 | Group 32 | GWSH | 1/17/2007 | COOP | Original | 3/14/2007 | 5/29/2007 | 25 | 762.70 | 31 |
| RH101 | B2 (F1♂ x CRR♀) | M41 - 134936464 | F63 | Group 30 | GWSH | 1/30/2007 | FRH | Extras | Not Needed | | | | |
| RH102 | B2 (F1♂ x CRR♀) | M43 - 134746323 | F61 | Group 11 | GWSH | 1/30/2007 | FRH | Extras | Not Needed | | | | |
| RH103 | B2 (F1♂ x CRR♀) | M3 - 134567394 | F62 | Group 35 | GWSH | 1/30/2007 | FRH | Extras | Not Needed | | | | |
| QT61 | CRR | M54 | F44 | GWSH | GWSH | 1/17/2007 | COOP | Original | 3/14/2007 | 5/29/2007 | 25 | 762.70 | 28 |
| QT62 | CRR | M55 | F45 | GWSH | GWSH | 1/17/2007 | COOP | Original | 3/7/2007 | 5/8/2007 | 25 | 646.70 | 78 |
| QT63 | CRR | M56 | F46 | GWSH | GWSH | 1/17/2007 | COOP | Original | 3/14/2007 | 5/29/2007 | 25 | 762.70 | 27 |
| QT64 | CRR | M57 | F47 | GWSH | GWSH | 1/17/2007 | COOP | Original | 3/17/2007 | 5/29/2007 | 25 | 736.70 | 47 |

Table 2.3. (continued). Family groups created for *M. cerebralis* resistance experiment conducted at the Colorado Cooperative Fish and Wildlife Unit (COOP) wet lab in 2006-2007.

| Group | Strain | Male | Female | Male Origin | Female Origin | Spawn Date | Location of Eggs | Status | Hatched | Dosed | Number | Degree Days | Tank |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| QT65 | CRR | M58 | F48 | GWSH | GWSH | 1/17/2007 | COOP | Original | 3/13/2007 | 5/25/2007 | 25 | 716.80 | 15 |
| QT66 | CRR | M59 | F49 | GWSH | GWSH | 1/17/2007 | COOP | Original | 3/12/2007 | 5/25/2007 | 25 | 725.20 | 39 |
| QT67 | CRR | M60 | F50 | GWSH | GWSH | 1/17/2007 | COOP | Original | 3/5/2007 | 5/4/2007 | 25 | 626.50 | 79 |
| QT68 | CRR | M61 | F51 | GWSH | GWSH | 1/17/2007 | COOP | Original | 3/5/2007 | 5/4/2007 | 25 | 626.50 | 80 |
| QT69 | CRR | M62 | F52 | GWSH | GWSH | 1/17/2007 | COOP | Original | 3/5/2007 | 5/4/2007 | 25 | 626.50 | 56 |
| QT70 | CRR | M63 | F53 | GWSH | GWSH | 1/17/2007 | COOP | Original | 3/10/2007 | 5/25/2007 | 25 | 742.30 | 5 |
| RH85 | CRR | M64 | F56 | GWSH | GWSH | 1/30/2007 | FRH | Extras | Not Needed | | | | |
| RH86 | CRR | M65 | F57 | GWSH | GWSH | 1/30/2007 | FRH | Extras | Not Needed | | | | |
| RH87 | CRR | M66 | F58 | GWSH | GWSH | 1/30/2007 | FRH | Extras | Not Needed | | | | |
| RH21 | F1 (CRR♂ x GR♀) | M22 | F13 | GWSH | BFRH - RW9 | 12/12/2006 | FRH | Original | 1/9/2007 | 3/21/2007 | 25 | 629.30 | 13 |
| RH22 | F1 (CRR♂ x GR♀) | M23 | F14 | GWSH | BFRH - RW9 | 12/12/2006 | FRH | Original | Dead as eggs | | | | |
| RH23 | F1 (CRR♂ x GR♀) | M24 | F15 | GWSH | BFRH - RW9 | 12/12/2006 | FRH | Original | Dead as eggs | | | | |
| RH24 | F1 (CRR♂ x GR♀) | M25 | F16 | GWSH | BFRH - RW9 | 12/12/2006 | FRH | Original | 1/9/2007 | 3/21/2007 | 25 | 629.30 | 33 |
| RH25 | F1 (CRR♂ x GR♀) | M26 | F17 | GWSH | BFRH - RW9 | 12/12/2006 | FRH | Original | 1/9/2007 | 3/13/2007 | 25 | 661.50 | 61 |
| RH26 | F1 (CRR♂ x GR♀) | M29 | F18 | GWSH | BFRH - RW9 | 12/12/2006 | FRH | Original | 1/9/2007 | 3/13/2007 | 25 | 661.50 | 54 |
| RH27 | F1 (CRR♂ x GR♀) | M30 | F19 | GWSH | BFRH - RW9 | 12/12/2006 | FRH | Original | 1/9/2007 | 3/21/2007 | 25 | 629.30 | 2 |
| RH28 | F1 (CRR♂ x GR♀) | M31 | F20 | GWSH | BFRH - RW9 | 12/12/2006 | FRH | Original | 1/9/2007 | 3/21/2007 | 25 | 629.30 | 48 |
| RH29 | F1 (CRR♂ x GR♀) | M33 | F21 | GWSH | BFRH - RW9 | 12/12/2006 | FRH | Original | Dead as eggs | | | | |
| RH30 | F1 (CRR♂ x GR♀) | M34 | F22 | GWSH | BFRH - RW9 | 12/12/2006 | FRH | Original | 1/9/2007 | 3/21/2007 | 25 | 629.30 | 37 |
| RH56 | F1 (CRR♂ x GR♀) | M49 | F39 | GWSH | BFRH - RW9 | 1/11/2007 | FRH | Replaced RH22 | 2/12/2007 | 4/27/2007 | 25 | 691.20 | 11 |
| RH57 | F1 (CRR♂ x GR♀) | M50 | F40 | GWSH | BFRH - RW9 | 1/11/2007 | FRH | Extras | Not Needed | | | | |
| RH58 | F1 (CRR♂ x GR♀) | M51 | F41 | GWSH | BFRH - RW9 | 1/11/2007 | FRH | Replaced RH23 | 2/8/2007 | 4/24/2007 | 25 | 697.10 | 14 |
| RH59 | F1 (CRR♂ x GR♀) | M52 | F42 | GWSH | BFRH - RW9 | 1/11/2007 | FRH | Extras | Dead as eggs | | | | |
| RH60 | F1 (CRR♂ x GR♀) | M53 | F43 | GWSH | BFRH - RW9 | 1/11/2007 | FRH | Replaced RH29 | 2/8/2007 | 4/24/2007 | 25 | 697.10 | 25 |
| RH100 | F1 (GR♂ x CRR♀) | M79 | F70 | BFRH - RW6 | GWSH | 1/30/2007 | FRH | Replaced RH93 | 2/27/2007 | 5/1/2007 | 25 | 679.30 | 52 |
| RH88 | F1 (GR♂ x CRR♀) | M67 | F58 | BFRH - RW6 | GWSH | 1/30/2007 | FRH | Original | 2/26/2007 | 5/11/2007 | 25 | 734.20 | 9 |
| RH89 | F1 (GR♂ x CRR♀) | M68 | F59 | BFRH - RW6 | GWSH | 1/30/2007 | FRH | Original | Dead as eggs | | | | |
| RH90 | F1 (GR♂ x CRR♀) | M69 | F59 | BFRH - RW6 | GWSH | 1/30/2007 | FRH | Original | Dead as eggs | | | | |

Table 2.3. (continued). Family groups created for *M. cerebralis* resistance experiment conducted at the Colorado Cooperative Fish and Wildlife Unit (COOP) wet lab in 2006-2007.

| Group | Strain | Male | Female | Male Origin | Female Origin | Spawn Date | Location of Eggs | Status | Hatched | Dosed | Number | Degree Days | Tank |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| RH91 | F1 (GR♂ x CRR♀) | M70 | F61 | BFRH - RW6 | GWSH | 1/30/2007 | FRH | Original | 2/27/2007 | 5/11/2007 | 25 | 722.80 | 20 |
| RH92 | F1 (GR♂ x CRR♀) | M71 | F62 | BFRH - RW6 | GWSH | 1/30/2007 | FRH | Original | 2/27/2007 | 5/1/2007 | 25 | 679.30 | 62 |
| RH93 | F1 (GR♂ x CRR♀) | M72 | F63 | BFRH - RW6 | GWSH | 1/30/2007 | FRH | Original | Dead as eggs | | | | |
| RH94 | F1 (GR♂ x CRR♀) | M73 | F64 | BFRH - RW6 | GWSH | 1/30/2007 | FRH | Original | 2/27/2007 | 5/11/2007 | 25 | 722.80 | 38 |
| RH95 | F1 (GR♂ x CRR♀) | M74 | F65 | BFRH - RW6 | GWSH | 1/30/2007 | FRH | Original | 2/27/2007 | 5/11/2007 | 25 | 722.80 | 34 |
| RH96 | F1 (GR♂ x CRR♀) | M75 | F66 | BFRH - RW6 | GWSH | 1/30/2007 | FRH | Original | 2/27/2007 | 5/1/2007 | 25 | 679.30 | 73 |
| RH97 | F1 (GR♂ x CRR♀) | M76 | F67 | BFRH - RW6 | GWSH | 1/30/2007 | FRH | Original | 2/27/2007 | 5/11/2007 | 25 | 722.80 | 44 |
| RH98 | F1 (GR♂ x CRR♀) | M77 | F68 | BFRH - RW6 | GWSH | 1/30/2007 | FRH | Replaced RH89 | 2/27/2007 | 5/1/2007 | 25 | 679.30 | 64 |
| RH99 | F1 (GR♂ x CRR♀) | M78 | F69 | BFRH - RW6 | GWSH | 1/30/2007 | FRH | Replaced RH90 | 2/27/2007 | 5/11/2007 | 25 | 722.80 | 17 |
| RH2 | F1 x B2 | M2 - 146147570A | F2 - 134521446A | Group 14 | Group 11 | 11/28/2006 | FRH | Extras | Not Needed | | | | |
| RH4 | F1 x B2 | M4 - 146216311A | F3 - 133653755A | Group 20 | Group 35 | 11/28/2006 | FRH | Extras | Not Needed | | | | |
| RH7 | F1 x B2 | M7 - 146217514A | F4 - 1348362296A | Group 29 | Group 36 | 11/28/2006 | FRH | Extras | Not Needed | | | | |
| RH1 | F2 | M1 - 133874590A | F1 - 133735465A | Group 30 | Group 25 | 11/21/2006 | FRH | Original | 12/19/2006 | 2/15/2007 | 25 | 640.40 | 49 |
| RH13 | F2 | M13 - 133648333A | F10 - 133957222A | Group 35 | Group 11 | 12/6/2006 | FRH | Original | 1/3/2007 | 3/6/2007 | 25 | 670.50 | 65 |
| RH14 | F2 | M14 - 134921616A | F11 - 133661673A | Group 32 | Group 25 | 12/6/2006 | FRH | Original | 1/3/2007 | 3/6/2007 | 24 | 670.50 | 67 |
| RH3 | F2 | M3 - 134567394A | F2 - 134521446A | Group 35 | Group 11 | 11/28/2006 | FRH | Original | 12/27/2006 | 3/6/2007 | 26 | 640.40 | 7 |
| RH38 | F2 | M41 - 134936464A | F29 - 133662650A | Group 30 | Group 31 | 12/28/2006 | FRH | Original | 2/3/2007 | 4/24/2007 | 25 | 707.80 | 46 |
| RH40 | F2 | M42 - 134961377A | F30 - 133723393A | Group 30 | Group 1 | 12/28/2006 | FRH | Original | 2/5/2007 | 4/24/2007 | 25 | 692.60 | 12 |
| RH42 | F2 | M43 - 134746323A | F31 - 134546717A | Group 11 | Group 31 | 12/28/2006 | FRH | Original | 1/30/2007 | 4/20/2007 | 25 | 700.30 | 6 |
| RH44 | F2 | M44 - 134757611A | F32 - 134519513A | Group 36 | Group 1 | 12/28/2006 | FRH | Original | 1/27/2007 | 4/6/2007 | 25 | 677.90 | 41 |
| RH45 | F2 | M45 - 135126471A | F33 - 134835230A | Group 1 | Group 43 | 12/28/2006 | FRH | Original | 2/3/2007 | 4/24/2007 | 25 | 707.80 | 21 |
| RH46 | F2 | M46 - 133611735A | F34 - 133961091A | Group 1 | Group 31 | 12/28/2006 | FRH | Original | 1/29/2007 | 4/3/2007 | 25 | 662.30 | 77 |
| RH47 | F2 | M47 - 133736183A | F35 - 134963295A | Group 36 | Group 28 | 12/28/2006 | FRH | Original | Dead as eggs | | | | |
| RH49 | F2 | M31 - 133752472A | F36 - 134616152A | Group 43 | Group 27 | 1/11/2007 | FRH | Original | 2/13/2007 | 4/17/2007 | 25 | 646.50 | 72 |
| RH5 | F2 | M5 - 133669695A | F3 - 133653755A | Group 11 | Group 35 | 11/28/2006 | FRH | Original | 12/27/2006 | 3/6/2007 | 25 | 640.40 | 4 |
| RH50 | F2 | M14 - 134921616A | F36 - 134616152A | Group 32 | Group 27 | 1/11/2007 | FRH | Original | 2/19/2007 | 5/8/2007 | 25 | 710.30 | 18 |
| RH51 | F2 | M46 - 133611735A | F37 - 134511752A | Group 1 | Group 30 | 1/11/2007 | FRH | Original | 2/20/2007 | 5/8/2007 | 25 | 702.40 | 26 |
| RH52 | F2 | M13 - 133648333A | F37 - 134511752A | Group 35 | Group 30 | 1/11/2007 | FRH | Original | 2/13/2007 | 4/17/2007 | 25 | 646.50 | 53 |

Table 2.3. (continued). Family groups created for *M. cerebralis* resistance experiment conducted at the Colorado Cooperative Fish and Wildlife Unit (COOP) wet lab in 2006-2007.

| Group | Strain | Male | Female | Male Origin | Female Origin | Spawn Date | Location of Eggs | Status | Hatched | Dosed | Number | Degree Days | Tank |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| RH53 | F2 | M3 - 134567394A | F37 - 134511752A | Group 35 | Group 30 | 1/11/2007 | FRH | Original | 2/18/2007 | 5/4/2007 | 25 | 679.20 | 1 |
| RH54 | F2 | M44 - 134757611A | F38 - 134963512A | Group 36 | Group 28 | 1/11/2007 | FRH | Original | 2/25/2007 | 5/11/2007 | 25 | 692.60 | 43 |
| RH55 | F2 | M54 - 133728447A | F38 - 134963512A | Group 27 | Group 28 | 1/11/2007 | FRH | Original | 2/22/2007 | 5/11/2007 | 25 | 715.70 | 29 |
| RH6 | F2 | M6 - 134569186A | F4 - 134836296A | Group 28 | Group 36 | 11/28/2006 | FRH | Original | 12/27/2006 | 3/6/2007 | 25 | 640.40 | 42 |
| RH81 | F2 | M46 - 133611735A | F54 - 134961627A | Group 1 | Group 31 | 1/17/2007 | FRH | Replaced RH47 | 2/17/2007 | 4/20/2007 | 25 | 639.80 | 51 |
| RH82 | F2 | M44 - 134757611A | F54 - 134961627A | Group 36 | Group 31 | 1/17/2007 | FRH | Extras | Not Needed | | | | |
| RH83 | F2 | M6 - 134569186A | F55 - 133668221A | Group 28 | Group 43 | 1/17/2007 | FRH | Extras | Not Needed | | | | |
| RH84 | F2 | M54 - 133728447A | F55 - 133668221A | Group 27 | Group 43 | 1/17/2007 | FRH | Extras | Not Needed | | | | |
| RH10 | GR | M10 | F7 | BFRH - RW2 | BFRH - RW6 | 11/29/2006 | FRH | Original | 12/27/2006 | 3/6/2007 | 25 | 640.40 | 22 |
| RH11 | GR | M11 | F8 | BFRH - RW2 | BFRH - RW6 | 11/29/2006 | FRH | Original | 12/27/2006 | 2/23/2007 | 25 | 661.90 | 60 |
| RH12 | GR | M12 | F9 | BFRH - RW2 | BFRH - RW6 | 11/29/2006 | FRH | Original | 12/27/2006 | 3/6/2007 | 25 | 640.40 | 23 |
| RH31 | GR | M31 | F23 | BFRH - RW6 | BFRH - RW9 | 12/13/2006 | FRH | Original | 1/11/2007 | 3/13/2007 | 25 | 656.20 | 70 |
| RH32 | GR | M32 | F24 | BFRH - RW6 | BFRH - RW9 | 12/13/2006 | FRH | Original | 1/11/2007 | 3/13/2007 | 25 | 656.20 | 75 |
| RH33 | GR | M33 | F25 | BFRH - RW6 | BFRH - RW9 | 12/13/2006 | FRH | Original | Dead as eggs | | | | |
| RH34 | GR | M34 | F26 | BFRH -RW6 | BFRH - RW9 | 12/13/2006 | FRH | Original | 1/10/2007 | 3/13/2007 | 25 | 668.20 | 50 |
| RH35 | GR | M35 | F27 | BFRH - RW6 | BFRH - RW9 | 12/13/2006 | FRH | Original | 1/11/2007 | 4/11/2007 | 24 | 797.8 | 19 |
| RH36 | GR | M36 | F28 | BFRH - RW6 | BFRH - RW9 | 12/13/2006 | FRH | Replaced RH33 | 1/11/2007 | 4/11/2007 | 25 | 797.8 | 45 |
| RH8 | GR | M8 | F5 | BFRH - RW2 | BFRH - RW6 | 11/29/2006 | FRH | Original | 12/27/2006 | 2/23/2007 | 25 | 661.90 | 58 |
| RH9 | GR | M9 | F6 | BFRH - RW2 | BFRH - RW6 | 11/29/2006 | FRH | Original | 12/27/2006 | 3/6/2007 | 25 | 640.40 | 10 |

Table 2.4. Control groups separated from family groups created for *M. cerebralis* resistance experiment conducted at the Colorado Cooperative Fish and Wildlife Unit (COOP) wet lab in 2006-2007.

| Group | Strain | Male | Female | Male Origin | Female Origin | Spawn Date | Location of Eggs | Status | Hatched | Dosed | Number | Degree Days | Tank |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| RH8 | GR | M8 | F5 | BFRH - RW2 | BFRH - RW6 | 11/29/2006 | FRH | Original | 12/27/2006 | N/A | 25 | N/A | C1 |
| RH11 | GR | M11 | F8 | BFRH - RW2 | BFRH - RW6 | 11/29/2006 | FRH | Original | 12/27/2006 | N/A | 25 | N/A | C14 |
| RH34 | GR | M34 | F26 | BFRH -RW6 | BFRH - RW9 | 12/13/2006 | FRH | Original | 1/10/2007 | N/A | 25 | N/A | C4 |
| RH36 | GR | M36 | F28 | BFRH - RW6 | BFRH - RW9 | 12/13/2006 | FRH | Replaced RH33 | 1/11/2007 | N/A | 25 | N/A | C11 |
| QT68 | CRR | M61 | F51 | GWSH | GWSH | 1/17/2007 | COOP | Original | 3/5/2007 | N/A | 25 | N/A | C15 |
| QT62 | CRR | M55 | F45 | GWSH | GWSH | 1/17/2007 | COOP | Original | 3/7/2007 | N/A | 25 | N/A | C16 |
| QT70 | CRR | M63 | F53 | GWSH | GWSH | 1/17/2007 | COOP | Original | 3/10/2007 | N/A | 25 | N/A | C10 |
| QT63 | CRR | M56 | F46 | GWSH | GWSH | 1/17/2007 | COOP | Original | 3/14/2007 | N/A | 25 | N/A | C7 |
| RH27 | F1 (CRR♂ x GR♀) | M30 | F19 | GWSH | BFRH - RW9 | 12/12/2006 | FRH | Original | 1/9/2007 | N/A | 25 | N/A | C19 |
| RH30 | F1 (CRR♂ x GR♀) | M34 | F22 | GWSH | BFRH - RW9 | 12/12/2006 | FRH | Original | 1/9/2007 | N/A | 25 | N/A | C20 |
| RH92 | F1 (GR♂ x CRR♀) | M71 | F62 | BFRH - RW6 | GWSH | 1/30/2007 | FRH | Original | 2/27/2007 | N/A | 25 | N/A | C17 |
| RH97 | F1 (GR♂ x CRR♀) | M76 | F67 | BFRH - RW6 | GWSH | 1/30/2007 | FRH | Original | 2/27/2007 | N/A | 25 | N/A | C2 |
| RH1 | F2 | M1 - 133874590A | F1 - 133735465A | Group 30 | Group 25 | 11/21/2006 | FRH | Original | 12/19/2006 | N/A | 25 | N/A | C9 |
| RH5 | F2 | M5 - 133669695A | F3 - 133653755A | Group 11 | Group 35 | 11/28/2006 | FRH | Original | 12/27/2006 | N/A | 25 | N/A | C13 |
| RH3 | F2 | M3 - 134567394A | F2 - 134521446A | Group 35 | Group 11 | 11/28/2006 | FRH | Original | 12/27/2006 | N/A | 26 | N/A | C3 |
| RH14 | F2 | M14 - 134921616A | F11 - 133661673A | Group 32 | Group 25 | 12/6/2006 | FRH | Original | 1/3/2007 | N/A | 25 | N/A | C6 |
| QT78 | B2 (F1♂ x CRR♀) | M5 - 133669695A | F45 | Group 11 | GWSH | 1/17/2007 | COOP | Original | 3/5/2007 | N/A | 25 | N/A | C5 |
| QT72 | B2 (F1♂ x CRR♀) | M45 - 135126471A | F54 | Group 1 | GWSH | 1/17/2007 | COOP | Original | 3/13/2007 | N/A | 25 | N/A | C8 |
| RH16 | B2 (CRR♂ x F1♀) | M17 | F10 - 133957222A | GWSH | Group 11 | 12/12/2006 | FRH | Original | 1/9/2007 | N/A | 25 | N/A | C12 |
| RH17 | B2 (CRR♂ x F1♀) | M18 | F11 - 133661673A | GWSH | Group 25 | 12/12/2006 | FRH | Original | 1/9/2007 | N/A | 25 | N/A | C18 |

Table 2.5. Batch weights and feed amounts for families on size 1 Rangen trout diet for *M. cerebralis* resistance experiment conducted at the Colorado Cooperative Fish and Wildlife Unit (COOP) wet lab in 2006-2007.

| Tank # | Group | Strain | Date on Size 1 | DD @ Size 0 | # Fish | Batch Weight | Feed 4% (grams) | Date Reduced | # Fish | Batch Weight | Feed 4% (grams) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 40 | RH15 | B2 CRR(m) x F1(f) | 3/3/2007 | 327.7 | 50 | 12 | 0.48 | 3/20/2007 | 25 | 10 | 0.4 |
| 63 | RH16 | B2 CRR(m) x F1(f) | 2/25/2007 | 347.4 | 50 | 22 | 0.88 | 3/12/2007 | 25 | 18 | 0.72 |
| C12 | RH16 | B2 CRR(m) x F1(f) | 2/25/2007 | 347.4 | 50 | 22 | 0.88 | 3/12/2007 | 25 | 20 | 0.8 |
| 3 | RH17 | B2 CRR(m) x F1(f) | 3/3/2007 | 327.7 | 50 | 21 | 0.84 | 3/20/2007 | 25 | 15 | 0.6 |
| C18 | RH17 | B2 CRR(m) x F1(f) | 3/3/2007 | 327.7 | 50 | 21 | 0.84 | 3/20/2007 | 25 | 17 | 0.68 |
| 16 | RH18 | B2 CRR(m) x F1(f) | 3/3/2007 | 327.7 | 50 | 18 | 0.72 | 3/20/2007 | 25 | 15 | 0.6 |
| 55 | RH20 | B2 CRR(m) x F1(f) | 2/25/2007 | 347.4 | 50 | 13 | 0.52 | 3/12/2007 | 25 | 12 | 0.48 |
| 66 | RH37 | B2 CRR(m) x F1(f) | 3/11/2007 | 349.2 | 50 | 15 | 0.6 | 3/29/2007 | 25 | 15 | 0.6 |
| 30 | RH39 | B2 CRR(m) x F1(f) | 3/15/2007 | 331.5 | 50 | 21 | 0.84 | 4/5/2007 | 25 | 20 | 0.8 |
| 32 | RH41 | B2 CRR(m) x F1(f) | 3/15/2007 | 331.5 | 50 | 15 | 0.6 | 4/5/2007 | 25 | 15 | 0.6 |
| 41 | RH43 | B2 CRR(m) x F1(f) | 3/15/2007 | 331.5 | 48 | 23 | 0.92 | 4/5/2007 | 25 | 21 | 0.84 |
| 68 | RH48 | B2 CRR(m) x F1(f) | 4/3/2007 | 383.2 | 50 | 18 | 0.72 | 4/10/2007 | 25 | 12 | 0.48 |
| 71 | QT71 | B2 F1(m) x CRR(f) | 4/30/2007 | 352.4 | 50 | 17 | 0.68 | 5/3/2007 | 25 | 9 | 0.36 |
| 8 | QT72 | B2 F1(m) x CRR(f) | 5/13/2007 | 358 | 50 | 19 | 0.76 | 5/24/2007 | 25 | 15 | 0.6 |
| C8 | QT72 | B2 F1(m) x CRR(f) | 5/13/2007 | 358 | 50 | 18 | 0.72 | 5/24/2007 | 25 | 14 | 0.56 |
| 76 | QT73 | B2 F1(m) x CRR(f) | 4/30/2007 | 342.2 | 50 | 17 | 0.68 | 5/3/2007 | 25 | 10 | 0.4 |
| 35 | QT74 | B2 F1(m) x CRR(f) | 5/13/2007 | 358 | 50 | 23 | 0.92 | 5/29/2007 | 25 | 20 | 0.8 |
| 74 | QT75 | B2 F1(m) x CRR(f) | 5/1/2007 | 333.2 | 50 | 15 | 0.6 | 5/3/2007 | 25 | 8 | 0.32 |
| 36 | QT76 | B2 F1(m) x CRR(f) | 5/13/2007 | 358 | 50 | 21 | 0.84 | 5/24/2007 | 25 | 16 | 0.64 |
| 59 | QT77 | B2 F1(m) x CRR(f) | 4/30/2007 | 342.2 | 50 | 18 | 0.72 | 5/7/2007 | 25 | 11 | 0.44 |
| 57 | QT78 | B2 F1(m) x CRR(f) | 4/30/2007 | 352.4 | 50 | 21 | 0.84 | 5/3/2007 | 25 | 12 | 0.48 |
| C5 | QT78 | B2 F1(m) x CRR(f) | 4/30/2007 | 352.4 | 50 | 21 | 0.84 | 5/3/2007 | 25 | 12 | 0.48 |
| 69 | QT79 | B2 F1(m) x CRR(f) | 5/1/2007 | 333.2 | 50 | 17 | 0.68 | 5/3/2007 | 25 | 11 | 0.44 |
| 31 | QT80 | B2 F1(m) x CRR(f) | 5/17/2007 | 363.1 | 50 | 16 | 0.64 | 5/29/2007 | 25 | 14 | 0.56 |
| 28 | QT61 | CRR | 5/13/2007 | 358 | 50 | 17 | 0.68 | 5/29/2007 | 25 | 15 | 0.6 |
| 78 | QT62 | CRR | 4/30/2007 | 352.4 | 50 | 17 | 0.68 | 5/7/2007 | 25 | 10 | 0.4 |
| C16 | QT62 | CRR | 4/30/2007 | 352.4 | 50 | 18 | 0.72 | 5/7/2007 | 25 | 10 | 0.4 |
| 27 | QT63 | CRR | 5/13/2007 | 358 | 50 | 18 | 0.72 | 5/29/2007 | 25 | 16 | 0.64 |

Table 2.5. (continued). Batch weights and feed amounts for families on size 1 Rangen trout diet for *M. cerebralis* resistance experiment conducted at the Colorado Cooperative Fish and Wildlife Unit (COOP) wet lab in 2006-2007.

| Tank # | Group | Strain | Date on Size 1 | DD @ Size 0 | # Fish | Batch Weight | Feed 4% (grams) | Date Reduced | # Fish | Batch Weight | Feed 4% (grams) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| C7 | QT63 | CRR | 5/13/2007 | 358 | 50 | 18 | 0.72 | 5/29/2007 | 25 | 16 | 0.64 |
| 47 | QT64 | CRR | 5/17/2007 | 363.1 | 50 | 16 | 0.64 | 5/29/2007 | 25 | 11 | 0.44 |
| 15 | QT65 | CRR | 5/13/2007 | 358 | 50 | 17 | 0.68 | 5/24/2007 | 25 | 13 | 0.52 |
| 39 | QT66 | CRR | 5/13/2007 | 358 | 50 | 18 | 0.72 | 5/24/2007 | 25 | 13 | 0.52 |
| 79 | QT67 | CRR | 4/30/2007 | 352.4 | 50 | 16 | 0.64 | 5/3/2007 | 25 | 9 | 0.36 |
| 80 | QT68 | CRR | 4/30/2007 | 352.4 | 50 | 17 | 0.68 | 5/3/2007 | 25 | 11 | 0.44 |
| C15 | QT68 | CRR | 4/30/2007 | 352.4 | 50 | 18 | 0.72 | 5/3/2007 | 25 | 10 | 0.4 |
| 56 | QT69 | CRR | 5/1/2007 | 333.2 | 50 | 17 | 0.68 | 5/3/2007 | 25 | 9 | 0.36 |
| 5 | QT70 | CRR | 5/8/2007 | 341.2 | 50 | 18 | 0.72 | 5/24/2007 | 25 | 16 | 0.64 |
| C10 | QT70 | CRR | 5/8/2007 | 341.2 | 50 | 18 | 0.72 | 5/24/2007 | 25 | 14 | 0.56 |
| 13 | RH21 | F1 CRR(m) x HOF(f) | 3/3/2007 | 327.7 | 50 | 21 | 0.84 | 3/20/2007 | 25 | 17 | 0.68 |
| 33 | RH24 | F1 CRR(m) x HOF(f) | 3/3/2007 | 327.7 | 37 | 19 | 0.76 | 3/20/2007 | 25 | 20 | 0.8 |
| 61 | RH25 | F1 CRR(m) x HOF(f) | 2/25/2007 | 347.4 | 50 | 21 | 0.84 | 3/12/2007 | 25 | 20 | 0.8 |
| 54 | RH26 | F1 CRR(m) x HOF(f) | 2/25/2007 | 347.4 | 50 | 22 | 0.88 | 3/12/2007 | 25 | 18 | 0.72 |
| 2 | RH27 | F1 CRR(m) x HOF(f) | 3/3/2007 | 327.7 | 50 | 21 | 0.84 | 3/20/2007 | 25 | 18 | 0.72 |
| C19 | RH27 | F1 CRR(m) x HOF(f) | 3/3/2007 | 327.7 | 50 | 22 | 0.88 | 3/20/2007 | 25 | 20 | 0.8 |
| 48 | RH28 | F1 CRR(m) x HOF(f) | 3/3/2007 | 327.7 | 27 | 15 | 0.6 | 3/20/2007 | 25 | 20 | 0.8 |
| 37 | RH30 | F1 CRR(m) x HOF(f) | 3/3/2007 | 327.7 | 50 | 22 | 0.88 | 3/20/2007 | 25 | 17 | 0.68 |
| C20 | RH30 | F1 CRR(m) x HOF(f) | 3/3/2007 | 327.7 | 50 | 22 | 0.88 | 3/20/2007 | 25 | 18 | 0.72 |
| 11 | RH56 | F1 CRR(m) x HOF(f) | 4/4/2007 | 338.6 | 50 | 22 | 0.88 | 4/26/2007 | 25 | 24 | 0.96 |
| 14 | RH58 | F1 CRR(m) x HOF(f) | 4/4/2007 | 338.6 | 50 | 23 | 0.92 | 4/23/2007 | 25 | 24 | 0.96 |
| 25 | RH60 | F1 CRR(m) x HOF(f) | 4/4/2007 | 338.6 | 50 | 20 | 0.8 | 4/23/2007 | 25 | 17 | 0.68 |
| 52 | RH100 | F1 HOF(m) x CRR(f) | 4/19/2007 | 346.7 | 50 | 19 | 0.76 | 4/30/2007 | 25 | 14 | 0.56 |
| 9 | RH88 | F1 HOF(m) x CRR(f) | 4/23/2007 | 333.6 | 50 | 23 | 0.92 | 5/10/2007 | 25 | 22 | 0.88 |
| 20 | RH91 | F1 HOF(m) x CRR(f) | 4/23/2007 | 333.6 | 50 | 20 | 0.8 | 5/10/2007 | 25 | 19 | 0.76 |
| 62 | RH92 | F1 HOF(m) x CRR(f) | 4/22/2007 | 358.1 | 50 | 30 | 1.2 | 4/30/2007 | 25 | 21 | 0.84 |
| C17 | RH92 | F1 HOF(m) x CRR(f) | 4/22/2007 | 358.1 | 50 | 28 | 1.12 | 4/30/2007 | 25 | 20 | 0.8 |

Table 2.5. (continued). Batch weights and feed amounts for families on size 1 Rangen trout diet for *M. cerebralis* resistance experiment conducted at the Colorado Cooperative Fish and Wildlife Unit (COOP) wet lab in 2006-2007.

| Tank # | Group | Strain | Date on Size 1 | DD @ Size 0 | # Fish | Batch Weight | Feed 4% (grams) | Date Reduced | # Fish | Batch Weight | Feed 4% (grams) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 38 | RH94 | F1 HOF(m) x CRR(f) | 4/23/2007 | 333.6 | 50 | 18 | 0.72 | 5/10/2007 | 25 | 18 | 0.72 |
| 34 | RH95 | F1 HOF(m) x CRR(f) | 4/23/2007 | 333.6 | 50 | 15 | 0.6 | 5/10/2007 | 25 | 12 | 0.48 |
| 73 | RH96 | F1 HOF(m) x CRR(f) | 4/19/2007 | 346.7 | 50 | 19 | 0.76 | 4/30/2007 | 25 | 13 | 0.52 |
| 44 | RH97 | F1 HOF(m) x CRR(f) | 4/23/2007 | 333.6 | 50 | 24 | 0.96 | 5/10/2007 | 25 | 21 | 0.84 |
| C2 | RH97 | F1 HOF(m) x CRR(f) | 4/23/2007 | 333.6 | 50 | 24 | 0.96 | 5/10/2007 | 25 | 20 | 0.8 |
| 64 | RH98 | F1 HOF(m) x CRR(f) | 4/22/2007 | 358.1 | 50 | 16 | 0.64 | 4/30/2007 | 25 | 11 | 0.44 |
| 17 | RH99 | F1 HOF(m) x CRR(f) | 4/23/2007 | 333.6 | 50 | 19 | 0.76 | 5/10/2007 | 25 | 16 | 0.64 |
| 44 | RH2 | F1xB2 | 2/14/2007 | 338.5 | 50 | 23 | 0.92 | N/A - Killed | N/A | N/A | N/A |
| 30 | RH4 | F1xB2 | 2/14/2007 | 338.5 | 50 | 19 | 0.76 | N/A - Killed | N/A | N/A | N/A |
| 34 | RH7 | F1xB2 | 2/14/2007 | 338.5 | 50 | 20 | 0.8 | N/A - Killed | N/A | N/A | N/A |
| 49 | RH1 | F2 F1(m) x F1(f) | 1/30/2007 | 337.2 | 50 | 19 | 0.76 | 2/14/2007 | 25 | 24 | 0.96 |
| C9 | RH1 | F2 F1(m) x F1(f) | 1/30/2007 | 337.2 | 50 | 20 | 0.8 | 2/14/2007 | 25 | 19 | 0.76 |
| 65 | RH13 | F2 F1(m) x F1(f) | 2/18/2007 | 340.5 | 50 | 18 | 0.72 | 3/5/2007 | 25 | 15 | 0.6 |
| 67 | RH14 | F2 F1(m) x F1(f) | 2/18/2007 | 340.5 | 50 | 19 | 0.76 | 3/5/2007 | 25 | 17 | 0.68 |
| C6 | RH14 | F2 F1(m) x F1(f) | 2/18/2007 | 340.5 | 50 | 20 | 0.8 | 3/5/2007 | 25 | 19 | 0.76 |
| 7 | RH3 | F2 F1(m) x F1(f) | 2/14/2007 | 338.5 | 50 | 22 | 0.88 | 3/5/2007 | 26 | 17 | 0.68 |
| C3 | RH3 | F2 F1(m) x F1(f) | 2/14/2007 | 338.5 | 50 | 23 | 0.92 | 3/5/2007 | 25 | 20 | 0.8 |
| 46 | RH38 | F2 F1(m) x F1(f) | 4/15/2007 | 344.8 | 50 | 19 | 0.76 | 4/23/2007 | 25 | 10 | 0.4 |
| 12 | RH40 | F2 F1(m) x F1(f) | 4/15/2007 | 344.8 | 50 | 22 | 0.88 | 4/23/2007 | 25 | 14 | 0.56 |
| 6 | RH42 | F2 F1(m) x F1(f) | 4/4/2007 | 338.6 | 50 | 14 | 0.56 | 4/19/2007 | 25 | 12 | 0.48 |
| 21 | RH45 | F2 F1(m) x F1(f) | 4/12/2007 | 341.5 | 50 | 14 | 0.56 | 4/23/2007 | 25 | 9 | 0.36 |
| 77 | RH46 | F2 F1(m) x F1(f) | 3/23/2007 | 334.1 | 50 | 19 | 0.76 | 4/2/2007 | 25 | 14 | 0.56 |
| 72 | RH49 | F2 F1(m) x F1(f) | 4/14/2007 | 330.7 | 50 | 12 | 0.48 | 4/16/2007 | 25 | 7 | 0.28 |
| 4 | RH5 | F2 F1(m) x F1(f) | 2/14/2007 | 338.5 | 50 | 20 | 0.8 | 3/5/2007 | 25 | 15 | 0.6 |
| C13 | RH5 | F2 F1(m) x F1(f) | 2/14/2007 | 338.5 | 50 | 19 | 0.76 | 3/5/2007 | 25 | 19 | 0.76 |
| 18 | RH50 | F2 F1(m) x F1(f) | 4/23/2007 | 333.6 | 50 | 18 | 0.72 | 5/7/2007 | 25 | 15 | 0.6 |
| 26 | RH51 | F2 F1(m) x F1(f) | 4/30/2007 | 343.2 | 50 | 14 | 0.56 | 5/7/2007 | 25 | 9 | 0.36 |
| 53 | RH52 | F2 F1(m) x F1(f) | 4/10/2007 | 331.4 | 50 | 17 | 0.68 | 4/16/2007 | 25 | 11 | 0.44 |

Table 2.5. (continued). Batch weights and feed amounts for families on size 1 Rangen trout diet for *M. cerebralis* resistance experiment conducted at the Colorado Cooperative Fish and Wildlife Unit (COOP) wet lab in 2006-2007.

| Tank # | Group | Strain | Date on Size 1 | DD @ Size 0 | # Fish | Batch Weight | Feed 4% (grams) | Date Reduced | # Fish | Batch Weight | Feed 4% (grams) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | RH53 | F2 F1(m) x F1(f) | 4/30/2007 | 343.2 | 50 | 20 | 0.8 | 5/3/2007 | 25 | 12 | 0.48 |
| 43 | RH54 | F2 F1(m) x F1(f) | 5/3/2007 | 346.3 | 50 | 17 | 0.68 | 5/11/2007 | 25 | 12 | 0.48 |
| 29 | RH55 | F2 F1(m) x F1(f) | 4/30/2007 | 343.2 | 50 | 16 | 0.64 | 5/10/2007 | 25 | 12 | 0.48 |
| 42 | RH6 | F2 F1(m) x F1(f) | 2/14/2007 | 338.5 | 50 | 21 | 0.84 | 3/5/2007 | 25 | 19 | 0.76 |
| 51 | RH81 | F2 F1(m) x F1(f) | 4/14/2007 | 330.7 | 50 | 10 | 0.4 | 4/19/2007 | 25 | 5 | 0.2 |
| 24 | RH83 | F2 F1(m) x F1(f) | 4/30/2007 | 343.2 | 50 | 12 | 0.48 | 5/11/2007 | 24 | 9 | 0.36 |
| 22 | RH10 | GR | 2/14/2007 | 338.5 | 50 | 19 | 0.76 | 3/5/2007 | 25 | 15 | 0.6 |
| 60 | RH11 | GR | 2/8/2007 | 335.9 | 50 | 18 | 0.72 | 2/22/2007 | 25 | 18 | 0.72 |
| C14 | RH11 | GR | 2/8/2007 | 335.9 | 50 | 20 | 0.8 | 2/22/2007 | 25 | 20 | 0.8 |
| 23 | RH12 | GR | 2/14/2007 | 338.5 | 50 | 22 | 0.88 | 3/5/2007 | 25 | 19 | 0.76 |
| 70 | RH31 | GR | 3/1/2007 | 329.6 | 50 | 14 | 0.56 | 3/12/2007 | 25 | 11 | 0.44 |
| 75 | RH32 | GR | 3/3/2007 | 329.3 | 50 | 30 | 1.2 | 3/12/2007 | 25 | 21 | 0.84 |
| 50 | RH34 | GR | 3/1/2007 | 329.6 | 50 | 14 | 0.56 | 3/12/2007 | 25 | 11 | 0.44 |
| C4 | RH34 | GR | 3/1/2007 | 329.6 | 50 | 13 | 0.52 | 3/12/2007 | 25 | 9 | 0.36 |
| 19 | RH35 | GR | 3/11/2007 | 331 | 50 | 14 | 0.56 | 4/10/2007 | 25 | 19 | 0.76 |
| 45 | RH36 | GR | 3/15/2007 | 334.1 | 50 | 13 | 0.52 | 4/10/2007 | 25 | 16 | 0.64 |
| C11 | RH36 | GR | 3/15/2007 | 334.1 | 50 | 13 | 0.52 | 4/10/2007 | 25 | 16 | 0.64 |
| 58 | RH8 | GR | 2/8/2007 | 335.9 | 50 | 21 | 0.84 | 2/22/2007 | 25 | 19 | 0.76 |
| C1 | RH8 | GR | 2/8/2007 | 335.9 | 50 | 20 | 0.8 | 2/22/2007 | 25 | 21 | 0.84 |
| 10 | RH9 | GR | 2/14/2007 | 338.5 | 50 | 22 | 0.92 | 3/5/2007 | 25 | 19 | 0.76 |

Table 2.6. Batch weights and feed amounts for families on size 2 Rangen trout diet for *M. cerebralis* resistance experiment conducted at the Colorado Cooperative Fish and Wildlife Unit (COOP) wet lab in 2006-2007.

| Tank # | Group | Strain | Date on Size 2 | DD @ Size 1 | # Fish | Grams | Feed 4% (grams) |
|---|---|---|---|---|---|---|---|
| C12 | RH16 | B2 CRR(m) x F1(f) | 5/7/2007 | 727.6 | 25 | 89 | 3.56 |
| 63 | RH16 | B2 CRR(m) x F1(f) | 5/7/2007 | 727.6 | 25 | 81 | 3.24 |
| C18 | RH17 | B2 CRR(m) x F1(f) | 5/15/2007 | 751.6 | 25 | 92 | 3.68 |
| 3 | RH17 | B2 CRR(m) x F1(f) | 5/15/2007 | 682.5 | 25 | 83 | 3.32 |
| 30 | RH39 | B2 CRR(m) x F1(f) | 5/17/2007 | 605 | 25 | 80 | 3.2 |
| 13 | RH21 | F1 CRR(m) x HOF(f) | 5/15/2007 | 682.5 | 25 | 99 | 3.96 |
| 33 | RH24 | F1 CRR(m) x HOF(f) | 5/15/2007 | 682.5 | 25 | 98 | 3.92 |
| 61 | RH25 | F1 CRR(m) x HOF(f) | 4/23/2007 | 590.9 | 25 | 88 | 3.52 |
| 54 | RH26 | F1 CRR(m) x HOF(f) | 5/7/2007 | 727.6 | 25 | 97 | 3.88 |
| C19 | RH27 | F1 CRR(m) x HOF(f) | 5/1/2007 | 605.8 | 24 | 82 | 3.28 |
| 2 | RH27 | F1 CRR(m) x HOF(f) | 5/15/2007 | 682.5 | 25 | 103 | 4.12 |
| 48 | RH28 | F1 CRR(m) x HOF(f) | 5/15/2007 | 682.5 | 25 | 110 | 4.4 |
| C20 | RH30 | F1 CRR(m) x HOF(f) | 5/1/2007 | 605.8 | 24 | 76 | 3.04 |
| 37 | RH30 | F1 CRR(m) x HOF(f) | 5/15/2007 | 682.5 | 25 | 89 | 3.56 |
| 49 | RH1 | F2 F1(m) x F1(f) | 4/12/2007 | 740.5 | 25 | 97 | 3.88 |
| C9 | RH1 | F2 F1(m) x F1(f) | 4/12/2007 | 740.5 | 25 | 106 | 4.24 |
| 65 | RH13 | F2 F1(m) x F1(f) | 4/30/2007 | 727 | 25 | 106 | 4.24 |
| 67 | RH14 | F2 F1(m) x F1(f) | 4/16/2007 | 574.7 | 24 | 79 | 3.16 |
| C6 | RH14 | F2 F1(m) x F1(f) | 4/16/2007 | 574.7 | 25 | 89 | 3.56 |
| C3 | RH3 | F2 F1(m) x F1(f) | 4/30/2007 | 767.4 | 25 | 96 | 3.84 |
| 7 | RH3 | F2 F1(m) x F1(f) | 5/14/2007 | 804.6 | 26 | 85 | 3.4 |
| C13 | RH5 | F2 F1(m) x F1(f) | 4/30/2007 | 767.4 | 25 | 100 | 4 |
| 4 | RH5 | F2 F1(m) x F1(f) | 5/14/2007 | 804.6 | 25 | 84 | 3.36 |
| 42 | RH6 | F2 F1(m) x F1(f) | 4/30/2007 | 661.4 | 25 | 95 | 3.8 |
| 22 | RH10 | GR | 4/30/2007 | 661.4 | 25 | 104 | 4.16 |
| 60 | RH11 | GR | 4/6/2007 | 586.5 | 25 | 92 | 3.68 |
| C14 | RH11 | GR | 4/6/2007 | 586.5 | 25 | 115 | 4.6 |
| 23 | RH12 | GR | 4/16/2007 | 525.5 | 25 | 90 | 3.6 |

Table 2.6. (continued). Batch weights and feed amounts for families on size 2 Rangen trout diet for *M. cerebralis* resistance experiment conducted at the Colorado Cooperative Fish and Wildlife Unit (COOP) wet lab in 2006-2007.

| Tank # | Group | Strain | Date on Size 2 | DD @ Size 1 | # Fish | Grams | Feed 4% (grams) |
|---|---|---|---|---|---|---|---|
| 70 | RH31 | GR | 5/7/2007 | 687.1 | 24 | 99 | 3.96 |
| 75 | RH32 | GR | 4/23/2007 | 530.5 | 25 | 108 | 4.32 |
| 50 | RH34 | GR | 5/7/2007 | 687.1 | 24 | 99 | 3.96 |
| C4 | RH34 | GR | 5/7/2007 | 687.1 | 19 | 81 | 3.24 |
| 58 | RH8 | GR | 4/6/2007 | 586.5 | 25 | 103 | 4.12 |
| C1 | RH8 | GR | 4/6/2007 | 586.5 | 25 | 122 | 4.88 |
| 10 | RH9 | GR | 4/16/2007 | 525.5 | 25 | 78 | 3.12 |

Table 2.7. Batch weights and feed amounts for families on size 3 Rangen trout diet for *M. cerebralis* resistance experiment conducted at the Colorado Cooperative Fish and Wildlife Unit (COOP) wet lab in 2006-2007.

| Tank # | Group | Strain | Date on Size 3 | DD @ Size 2 | # Fish | Grams | Feed 4% (grams) |
|---|---|---|---|---|---|---|---|
| 49 | RH1 | F2 F1(m) x F1(f) | 5/10/2007 | 296.9 | 25 | 169 | 6.76 |
| C9 | RH1 | F2 F1(m) x F1(f) | 5/10/2007 | 296.9 | 25 | 181 | 7.24 |
| C6 | RH14 | F2 F1(m) x F1(f) | 5/14/2007 | 298 | 25 | 178 | 7.12 |
| 22 | RH10 | GR | 5/14/2007 | 143.2 | 25 | 170 | 6.8 |
| C14 | RH11 | GR | 4/20/2007 | 145.5 | 25 | 190 | 7.6 |
| 60 | RH11 | GR | 5/4/2007 | 294.4 | 25 | 234 | 9.36 |
| 23 | RH12 | GR | 5/14/2007 | 279.1 | 25 | 208 | 8.32 |
| 75 | RH32 | GR | 5/7/2007 | 146.7 | 25 | 178 | 7.12 |
| C1 | RH8 | GR | 4/20/2007 | 145.5 | 25 | 193 | 7.72 |
| 58 | RH8 | GR | 5/4/2007 | 294.4 | 25 | 243 | 9.72 |
| 10 | RH9 | GR | 5/14/2007 | 279.1 | 25 | 207 | 8.28 |

**Job No. 3:** **Whirling Disease Resistant Domestic Brood Stock Development and Evaluation**

**Job Objective:** These experiments are focused on the performance of the Hofer (GR) strain and GR-Harrison strain as domestic production fish compared with other commonly used production fish.

## Hatchery Performance Evaluations: Performance of a whirling disease resistant rainbow trout strain at two *Myxobolus cerebralis*-positive trout rearing facilities.


### ABSTRACT

A recently identified strain of rainbow trout with resistance to whirling disease (GR) was compared with Tasmanian and Bellaire rainbow trout strains in two separate trout rearing facilities to evaluate its performance and susceptibility to *M. cerebralis* infection under standard rearing conditions. Fish were brought to the facilities as either advanced fingerlings or as eyed eggs. Growth in the GR strain was significantly faster than in these other two domestic strains. Infection severity and prevalence in the GR strain was significantly lower than in the other two strains. These results demonstrate that the GR strain may be a useful replacement for more susceptible strains in facilities with a history of *M. cerebralis* infection.


### INTRODUCTION

Whirling disease, caused by *Myxobolus cerebralis* is known to cause severe declines in wild rainbow trout populations, particularly in the Intermountain West (Nehring and Walker 1996, Vincent 1996). The parasite has become established in many fish culture facilities as well. For example, fish in 10 of Colorado's 14 state-operated trout rearing facilities were identified as infected with the parasite as recently as 1997 (Rich Kolecki, Colorado Division of Wildlife Chief of Hatcheries, personal communication). While infections from the parasite in hatchery situations do not typically result in heavy mortality, other detrimental effects such as compromised growth, performance, and conformation of the infected fish can occur. This can result in reduced marketability of the fish in commercial operations. Possible spread of the parasite from infected facilities can also be a damaging consequence. Spread of *M. cerebralis* through human transfer of infected fish is well documented, and considered to be one of the primary routes of dispersal (Hoffmann 1990, Modin 1998, Bartholomew and Reno 2002). Stocking of infected fish has been shown to increase the likelihood of *M. cerebralis* establishment (Schisler 2002), and greatly increase the ambient parasite load and infection severity in fish in the near vicinity and downstream of the stocked locations (Nehring 2006). In some states, regulations require that facilities harboring the parasite be depopulated and the parasite eliminated from the water supply or the facilities be closed.

Fish culture problems related to whirling disease infection can be alleviated in many cases through improved management practices to reduce or eliminate the parasite (Hoffman 1990). Solutions include using well water or water treatment to ensure parasite-free water supplies. Hatchery renovation, such as installation of concrete raceways or lining earthen ponds can also help eliminate habitat for the intermediate host, *Tubifex tubifex*. These practices can greatly reduce the incidence and prevalence of infection in some locations. In Colorado, hatchery improvements have eliminated the parasite from seven of the facilities previously identified as positive for the parasite. The parasite cannot be eliminated in some facilities because of reliance on infected water sources. In these situations, hatchery managers may be somewhat limited in their ability to reduce infection prevalence and severity.

Many previous studies have demonstrated that rainbow trout are quite vulnerable to whirling disease (Thompson et. al 1999, Hedrick et al. 1999, Vincent 2002), and until recently, all rainbow trout strains were considered to be very susceptible to the parasite. The discovery of whirling disease-resistant rainbow trout strains (Hedrick et al. 2003, Schisler et al. 2006, Wagner et al. 2006) has provided hope that effects of the parasite could be further alleviated through the use of these resistant strains in trout rearing facilities where *M. cerebralis* cannot be completely eradicated. The potential use of these strains as a method to reduce impacts due to *M. cerebralis* has generated considerable interest. Performance of the GR strain in typical fish culture situations in the United States has not yet been evaluated, and verification of the resistance of these strains to whirling disease under normal culture conditions is needed to determine if their use is a viable option. This study was designed to evaluate the growth and survival of the GR strain when compared with other standard domestic strains in representative hatchery situations.

## METHODS

GR strain rainbow trout were evaluated at two separate state-operated *M. cerebralis*-positive trout rearing facilities. Both of these facilities rely on surface water, and have a history of infection in fish reared at these locations. Bellaire strain and Tasmanian strain rainbow trout are commonly used in Colorado as a catchable rainbow trout product for put-and-take and put-grow-and-take fisheries. In both of the trials described herein, the Bellaire and Tasmanian strain lots were reared through their normal production cycle, and matched with equal numbers of the GR strain to compare the growth and infectivity between the strains.

*Chalk Cliffs Rearing Unit.* – The Chalk Cliffs Rearing Unit is located in the upper Arkansas River drainage near Nathrop, Colorado, at an elevation of 2,438 meters. The facility was first identified as positive for *M. cerebralis* in March, 1988. The facility relies on surface water from Chalk Creek, and fish are reared in a series of raceways and earthen ponds. Warm springs in Chalk Creek result in an increased ambient temperature through the winter months (Figure 3.1). Myxospore counts in fish collected from the ponds on the facility during annual disease inspections have at times averaged over one million per fish. Improved management practices such as regular removal of moralities and rotation of active ponds, with periodic drying and excavating, have helped reduce myxospore counts in recent years. However, because of its reliance on surface water, the Chalk Cliffs facility cannot be completely rid of the parasite.

Eyed eggs of the GR and Tasmanian strain rainbow trout were transported to the facility in December, 2005. The eggs hatched within a day of each other, and fry were reared together in 0.2 x 3.5 m troughs in a hatchery building, fed with 38-53 liters per minute surface water. At six months post-hatch, the fish were moved to 1 x 50 m raceways with a flow of 4,920 liters per minute for further growth, then to a 0.47 hectare pond for final grow-out at 11 months post-hatch. Growth was measured periodically throughout the rearing period, starting at four months post-hatch, by using wet weights. Direct length measurements for statistical comparisons were made at nine and a half months and one year post-hatch.

Samples were collected to test for *M. cerebralis* infection and prevalence at three months post-hatch (1,002 degree-days ºC). Ten fish from each lot were collected and euthanized with tricaine methanesulfonate for histological analysis. Because of the size of the fish, they were fixed whole in Davidson's solution for 48 hours and then transferred to 70% ethanol. The bodies were embedded in paraffin, sectioned and stained with hematoxylin and eosin by standard procedures (Humason 1979). Two sections, one 30 microns deeper than the other, for each fish were evaluated for the presence of microscopic lesions due to *M. cerebralis*. The severity of microscopic lesions present in stained tissue sections were evaluated by the MacConnell-Baldwin scale using a scale from 0 – 5 with 5 representing the most severe lesions and 0 indicating no abnormalities seen (Hedrick et al. 1999b, Baldwin et al. 2000).

At five months post-hatch (1,934 degree-days ºC), ten fish of each strain were again collected for histological analysis and 10 fish of each strain were collected for PTD analysis. Heads were removed from the sample fish. Whole heads designated for histological sectioning were preserved in Davidson's solution. Histological procedures were conducted as described above. If used for PTD analysis, heads were placed in individually labeled plastic bags, and then held at – 20$^{o}$C until processing. The samples were then soaked in water at 45°C to soften the tissues, and then skeletal elements were separated from soft tissue by agitation in a wrist-action electric shaker using glass marbles as hammers. The samples were then decanted through disposable 190 µm calculi filters and rinse water was added back to the skeletal elements for purification and concentration by PTD (Markiw and Wolf 1974) and myxospore quantification (O'Grodnick 1975).

A third sample was collected during the facilities annual disease inspection, at nine months post-hatch (3,468 degree-days ºC). This collection occurred after the fish had been in the raceways for three and a half months (1,402 degree-days ºC). Thirty fish of each strain were collected for testing with PTD. These fish were processed for whole-head analysis as described previously.

Proc GLM in SAS system software was used to conduct tests in a general linear model framework for differences in growth and infection severity (dependent continuous variables) between strains (independent classification variable) for data collected during each sampling event. Wet weights over the course of the grow-out period were also compared using Proc GLM, in a simple regression analysis. This analysis used strain as an independent classification variable, days post-hatch as an independent continuous variable, and weight as a dependent continuous variable. Alpha was set at 0.05 for all tests of differences in growth and infection severity.

*Poudre Rearing Unit* - The Poudre Rearing Unit is located at an elevation of 2,347 meters above sea level in the Cache la Poudre Canyon, Northwest of Fort Collins, Colorado. The facility relies on surface water drawn from the Cache la Poudre River, which results in very slow growth at the facility during the winter months, when temperatures drop to near freezing from September through April (Figure 3.2). The facility has been positive for *M. cerebralis* since June of 1988. Fish produced at the Poudre Rearing Unit are typically brought to the facility in the late summer or fall of the year from the Bellvue Hatchery, near Laporte, Colorado, as 8 to 16-cm fingerlings. Fish reared at the facility are used as a catchable product or as replacement brood fish.

GR and Bellaire strain rainbow trout were brought to the Poudre Rearing Unit in late July, 2005, as 15-cm (43-45 g) *M. cerebralis*-negative fingerlings. Each lot consisted of 1,550 fish. The GR rainbow trout were seven months post-hatch, and the Bellaire rainbow trout were nine and a half months post-hatch. The age difference was necessary to match the sizes of the fish, due to the rapid early growth of the GR trout. Increase in size and age at exposure has been demonstrated to reduce infection severity in rainbow trout (Markiw 1992, Ryce et al. 2005). The GR rainbow trout were younger and therefore presumably more susceptible to infection as a function of age than the Bellaire rainbow trout when brought to the facility. The adipose fin was removed from GR rainbow trout two weeks prior to transport to ensure the fish could be easily identified when samples were collected.

The fish were held together in a single (1.8 m x 30.4 m) raceway, with a flow of 3,218 to 3,407 liters per minute. Fish were fed ad libitum with demand feeders during the summer months, and a daily maintenance ration 0.5%-2% body weight during the winter months when temperatures were below 2º C. Growth was monitored for one year at the facility.

Samples were collected for histological examinations and myxospore counts four months (970 degree-days ºC) after the fish were transported to the facility. Thirty fish of the GR and Bellaire rainbow trout were collected for the evaluations. The fish were euthanized with tricaine methanesulfonate, then weighed and measured. Heads were removed from the fish and split in two equal halves along the dorsal midline for histological analysis and pepsin-trypsin digest (PTD).

Subsequent samples of 30 fish of each strain were collected at eight months (1,039 degree-days ºC) and one year (1,617 degree-days ºC) after the fish were brought to the facility. The entire head of each fish was collected and processed with PTD as described above in these samples. Average myxospore counts were compared between the two strains for each of the three sampling events. As with the data collected from the Chalk Cliffs evaluation, Proc GLM in SAS System software was used to test for differences in growth and infection severity for data collected during each sampling event, and alpha was set at 0.05 for all tests.

## RESULTS

### *Chalk Cliffs Rearing Unit*

*Growth* – At the Chalk Cliffs Rearing Unit, growth as measured by average weight in the GR strain was much faster than the Tasmanian strain (Figure 3.3). A simple linear regression model with days post-hatch as an independent continuous variable and strain as an independent classification variable resulted in a very good fit ($R^2$ = 0.8914). Both strain ($F_{[1, 19]}$ =23.70, $P < 0.0001$) and days post-hatch ($F_{[1, 19]}$ =132.23, $P < 0.0001$) were found to be significant parameters in this model. More complicated models were explored, with similar results. Growth differences were also quite different when direct length measurements were compared. At nine and a half months post-hatch, average length of GR strain was 23.6 cm (n = 60, SD = 1.5), and 18.5 cm (n = 60, SD = 2.4) for the Tasmanian strain. At one year post-hatch, the GR strain averaged 28.4 cm (n = 50, SD = 2.8), while the Tasmanian strain averaged 22.3 cm (n = 50, SD = 3.3). These differences were significant between the two strains during both the first ($F_{[1, 118]}$ =199.26, $P < 0.0001$) and second ($F_{[1, 98]}$ = 100.85, $P < 0.0001$) sampling events.

*M. cerebralis Infection***.** – Statistical test results for comparison of the infection severity and prevalence in the two strains for all of the sampling events at the Chalk Cliffs Rearing Unit are provided in Table 3.1. Samples collected at three months post-hatch were identified as negative with histology in both the GR and Tasmanian rainbow trout. Samples collected at five months post-hatch also resulted in negative results for both histology and PTD in both strains. At nine and a half months post-hatch, infection prevalence in the GR strain was 73.3%, and prevalence in the Tasmanian strain was 96.7% Average whole-head myxospore count in the GR strain was 5,175 (n = 30, SD = 7,643), compared with 48,883 (n = 30, SD = 50,825) in the Tasmanian strain. The differences in myxospore counts were highly significant ($F_{[1, 58]}$ = 21.70 $P < 0.0001$).

### *Poudre Rearing Unit*

*Growth* - At the Poudre Rearing Unit, size in the GR rainbow trout was closely matched to the Bellaire rainbow trout for the first four months at the facility, with the GR rainbow trout averaging 24.3 cm (n = 30, SD = 2.1) versus 23.6 cm (n = 30, SD = 2.2) for the Bellaire rainbow trout. These differences were not significant ($F_{[1, 58]}$ = 1.86, $P$ = 0.1779). At eight months, growth in the GR strain was slightly better (26.1 cm, n = 30, SD = 17.2) than the Bellaire (24.9 cm, n = 30, SD = 4.0), but the difference was not significant ($F_{[1, 58]} = 2.31$, $P = 0.1340$). By one year on the facility, the GR rainbow trout (35.0 cm, n = 30, SD = 4.3) were significantly ($F_{[1, 58]} = 19.07$, $P < 0.0001$) larger than the Bellaire strain (30.4 cm, n = 30, SD = 3.7).

Average weights of the two strains followed the same pattern as the lengths. After four months on the facility, the GR rainbow trout averaged 173.0 g (n = 30, SD = 48.0), and the Bellaire rainbow trout averaged 171.0 g (n = 30, SD = 44.5). These differences were not significant ($F_{[1, 58]} = 0.04$, $P = 0.8373$). After eight months on the on the facility, the GR strain averaged 190.5 g (n = 30, SD = 40.1), while the Bellaire strain averaged 180.1 g (n = 30, SD = 60.5). Again, the weights were not significantly different ($F_{[1, 58]} = 0.61$, $P = 0.4370$). When sampled at one year on the facility, the GR strain averaged 493.1 g (n = 30, SD = 132.9 g), and the Bellaire strain averaged 375.4 g (n = 30, SD = 122.1). Despite being an equivalent size, but younger than the Bellaire rainbow trout at the beginning of the grow-out period, the GR strain were significantly heavier ($F_{[1, 58]} = 12.74$, $P = 0.0007$) than the Bellaire strain.

*M. cerebralis* Infection - Testing for *M. cerebralis* resulted in identification of significantly higher prevalence and infection severity in the Bellaire rainbow trout than in the GR strain at the Poudre Rearing Unit (Figure 3.4). After four months, no infection was found in the head cartilage of any of the GR rainbow trout with histology, while lesions were found in 43.3% of the Bellaire rainbow trout. Histological scores in the Bellaire rainbow trout were low, with an average of 0.57 (SD = 0.73) on the McConnell-Baldwin scale of 0 – 5. No myxospores were found in any of the GR rainbow trout (n = 30) after four months. Prevalence of infection in the Bellaire strain as measured by PTD was 46.7% (n = 30), with an average (half-head) myxospores count of 3,657 (SD = 7,044).

Samples collected for PTD analysis after eight months resulted in only three of the GR rainbow trout identified as infected, with an average whole-head myxospore count of 3,440 (n =30, SD = 20,445). All of the Bellaire rainbow trout were found to be infected, with an average whole-head myxospore count of 84,993 (n = 30, SD = 86,791).

Samples collected after the two strains had been reared for one year on the facility identified none of the GR rainbow trout (n = 30) as infected, while 90% (n = 30) of the Bellaire rainbow trout were identified as infected, with an average myxospore count of 361,099 (SD = 376,794 ) per fish.

Statistical test results for comparison of the infection severity and prevalence in the two strains for all of the sampling events at the Poudre Rearing Unit are provided in Table 3.2. The GR strain produced significantly ($P < 0.05$) lower infection severity and prevalence for each of the sampling events and testing methods.

## DISCUSSION

Growth of the GR strain rainbow trout was significantly better than both the Tasmanian strain rainbow trout at the Chalk Cliffs Rearing Unit and the Bellaire rainbow trout at the Poudre Rearing Unit. Growing conditions and temperature regimes were quite different at the two facilities, but the growth advantage of the GR strain was apparent at both locations. At the Chalk Cliffs Rearing Unit, where the two strains were reared under identical conditions from hatch, the GR strain reached stocking size of 23 cm, four months sooner than the Tasmanian strain. At the Poudre Rearing Unit, the GR and Tasmanian strain maintained relatively equal growth rates until the spring following transport to the facility, when accelerated growth occurred in the GR strain. This resulted in the GR strain fish outgrowing the Bellaire rainbow trout by the end of the evaluation, even though the Bellaire strain fish were two and a half months older than the GR strain fish at the beginning of the rearing period.

Infection prevalence and severity were significantly lower in the GR strain than both the Tasmanian and Bellaire strains by histological evaluation and myxospore counts in each of the sampling events in which the parasite was detected. Infection differences between the Tasmanian and the GR fish reared at the Chalk Cliffs facility were quite large, albeit not as pronounced by the end of the experiment as at the Poudre Rearing Unit. Initial exposure to *M. cerebralis* at Chalk Cliffs likely occurred after the fish were moved from the hatchery building to the raceways, at about six months post-hatch.

The large differences in infection severity between the Bellaire and GR strains at the Poudre Rearing Unit are underscored by the increasing myxospore count in the Bellaire rainbow trout throughout the evaluation period. High prevalence of infection in the Bellaire rainbow trout also demonstrates the high susceptibility of the strain to infection. Only three of the GR strain fish were identified as *M. cerebralis*-positive in the Poudre Rearing Unit evaluations. These were found during the sample collected at eight months after the beginning of the rearing period. These results indicate that the infection was quite low, but present at marginally detectable levels, in the GR strain fish. With much larger sample sizes, more infected GR fish would likely have been found at each of the sampling events.

Potential consequences of rearing and stocking a highly susceptible strain such as the Bellaire or Tasmanian rainbow trout are obvious. The parasite burden from these infected fish has the potential to greatly amplify the infection in both waters downstream from the facility if escapement occurs and in waters where the fish are stocked.

The results of these evaluations demonstrate that the GR strain has reduced infection prevalence and severity, as well as greater growth potential compared with other typical hatchery strains. The GR strain is a prospective replacement for these strains used for purely production purposes in areas where *M. cerebralis* is endemic, specifically where the parasite cannot be completely eradicated from water supplies.

Additional benefit could be realized from use of this or other resistant strains in facilities that do not harbor the parasite if fish are eventually stocked into waters where the parasite exists. Fish that are negative for the parasite, which are stocked into waters where *M. cerebralis* is endemic, can and do become infected after release (Nehring 2006). If these fish are not captured and removed before mature myxospores are developed, the end result can be an increase in parasite burden in the system. This reduces, and could completely negate, the benefits of stocking *M. cerebrali*s-negative fish where the parasite already exists. A strain such as the GR, which does not develop high levels of infection after release into waters where *M. cerebralis* is endemic, would help reduce the overall parasite burden in the receiving water.

The GR strain has preformed favorably under the typical fish culture conditions described in these evaluations. Further evaluations are planned for performance of the GR strain as a hatchery product. Post-stocking performance is also an important consideration for hatchery-reared rainbow trout strains. Survival, harvest, and angler satisfaction of the strains in put-and-take fisheries are in progress.

Figure 3.1. Daily mean temperature, cumulative temperature units, and sample collections at the Chalk Cliffs Rearing Unit from January 2005 to January 2006.

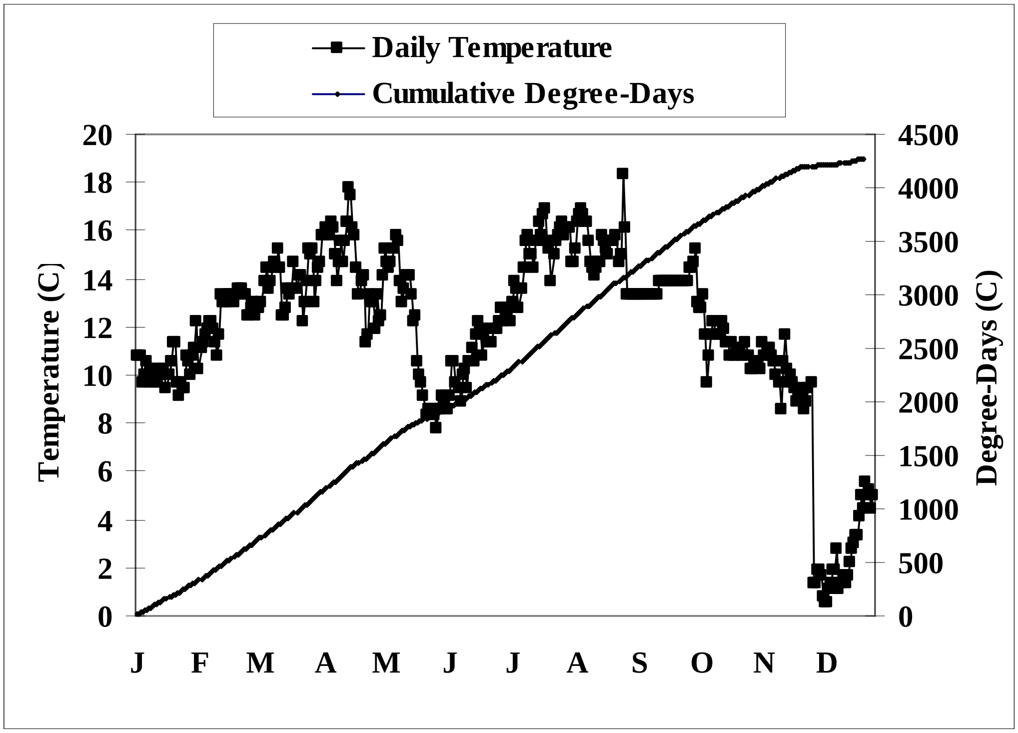



Figure 3.2. Daily mean temperature, cumulative temperature units, and sample collections at the Poudre Rearing Unit from July 2005 to July 2006.

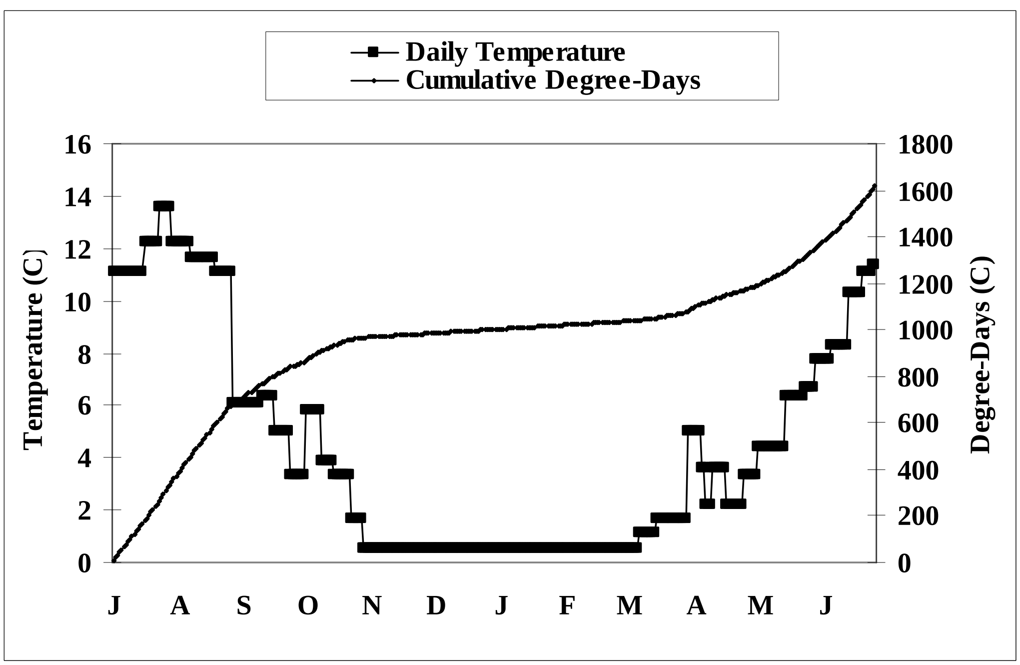


Figure 3.3. Growth rates for the GR and Tasmanian strain rainbow trout at the Chalk Cliffs Rearing Unit.

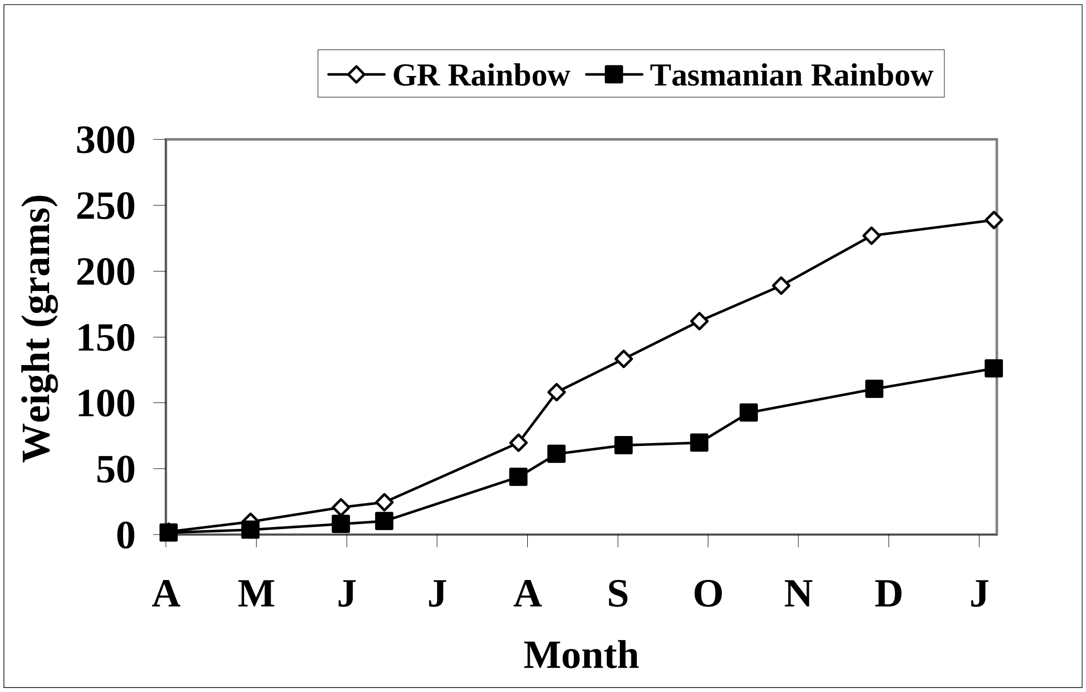



Figure 3.4. Myxospore counts for GR and Bellaire rainbow trout at four months, eight months, and one year at the Poudre Rearing Unit.

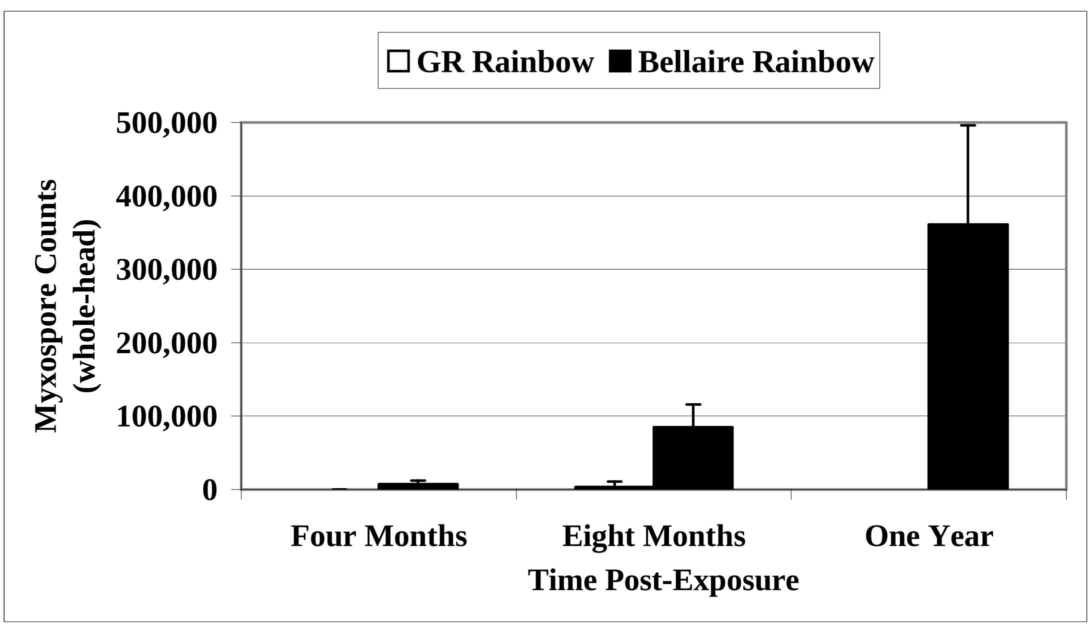


Table 3.1. Results of *M. cerebralis* infection evaluations at the Chalk Cliffs Rearing Unit. F-tests for comparisons of infection severity between the Tasmanian and GR strain rainbow trout are provided for each sample event.

| | **Tasmanian Rainbow Trout** | | | **GR Rainbow Trout** | | | **F-Test** |
|---|---|---|---|---|---|---|---|
| | N | Infected (%) | Severity | N | Infected (%) | Severity | |
| **Sample 1 (1,002 degree-days ºC)** | | | | | | | |
| Histology Score (whole- body) | 10 | 0 | 0 | 10 | 0 | 0 | $F_{[1, 18]} = 0.0$, $P = 1.0$ |
| **Sample 2 (1,934 degree-days ºC)** | | | | | | | |
| Histology Score (whole-head) | 10 | 0 | 0 | 10 | 0 | 0 | $F_{[1, 18]} = 0.0$, $P = 1.0$ |
| Myxospore Count (whole-head) | 10 | 0 | 0 | 10 | 0 | 0 | $F_{[1, 18]} = 0.0$, $P = 1.0$ |
| **Sample 3 (3,468 degree-days ºC)** | | | | | | | |
| Myxospore Count (whole-head) | 30 | 96.7 | 48,883 | 30 | 73.3 | 5,175 | $F_{[1, 58]} = 21.70$, $P < 0.0001$ |

Table 3.2. Results of *M. cerebralis* infection evaluations at the Poudre Rearing Unit. F-tests for comparisons of infection severity between the Bellaire and GR strain rainbow trout are provided for each sample event.

| | Bellaire Rainbow Trout | | | GR Rainbow Trout | | | F-Test |
|---|---|---|---|---|---|---|---|
| | N | Infected (%) | Severity | N | Infected (%) | Severity | |
| **Sample 1 (970 degree-days °C)** | | | | | | | |
| Histology Score (half-head) | 30 | 43.3 | 0.57 | 30 | 0 | 0 | $F_{[1, 58]} = 16.11$, $P = 0.0002$ |
| Myxospore Count (half-head) | 30 | 46.7 | 3,657 | 30 | 0 | 0 | $F_{[1, 58]} = 8.09$, $P = 0.0061$ |
| **Sample 2 (1,039 degree-days °C)** | | | | | | | |
| Myxospore Count (whole-head) | 30 | 100.0 | 84,993 | 30 | 10 | 3,440 | $F_{[1, 58]} = 24.66$, $P < 0.0001$ |
| **Sample 3 (1,617 degree-days °C)** | | | | | | | |
| Myxospore Count (whole-head) | 30 | 90.0 | 361,099 | 30 | 0 | 0 | $F_{[1, 58]} = 27.55$, $P < 0.0001$ |

## REFERENCES


Bartholomew, J. L., and P. W. Reno. 2002. The history and dissemination of whirling disease. Pages 3-24 *in* J. L. Bartholomew and J. C. Wilson, editors. Whirling disease: reviews and current topics. American Fisheries Society, Symposium 29, Bethesda, Maryland.

Hedrick, R. P., T. S. McDowell, G. D. Marty, G. T. Fosgate, K. Mukkatira, K. Myklebust, and M. El-Matbouli. 2003. Susceptibility of two strains of rainbow trout (one with suspected resistance to whirling disease) to *Myxobolus cerebralis* infection. Diseases of Aquatic Organisms 55: 37-44.

Hedrick, R. P., T. S. McDowell, K. Mukkataira, M. P. Georgiadis, and E. MacConnell. 1999. Susceptibility of selected inland salmonids to experimentally induced infections with *Myxobolus cerebralis*, the causative agent of whirling disease. Journal of Aquatic Animal Health 11: 330-339.

Hoffmann, G. L. 1990. *Myxobolus cerebralis,* a worldwide cause of salmonid whirling disease. Journal of Aquatic Animal Health 2: 30-37.

Markiw, M. E. 1992. Experimentally induced whirling disease I. Dose response of fry and adults of rainbow trout exposed to the triactinomyxon stage of *Myxobolus cerebralis.* Journal of Aquatic Animal Health 4: 40-43.

Modin, J. 1998. Whirling disease in California: A review of its history, distribution, and impacts, 1965-1997. Journal of Aquatic Animal Health 10:132-142.

Nehring, R. B. 2006. Colorado's cold water fisheries: whirling disease case histories and insights for risk management. Special Report Number 79. February 2006. Colorado Division of Wildlife, Denver, Colorado.

Nehring, R. B., and P. G. Walker. 1996. Whirling disease in the wild: the new reality in the intermountain west. Fisheries (Bethesda) 21: 28-32.

Ryce, E. K. N., A. V. Zale, E. MacConnell, and M. Nelson. 2005. Effects of fish age versus size on the development of whirling disease in rainbow trout. Diseases of Aquatic Organisms 63: 69-76.

Schisler, G. J., K. A. Myklebust, and R. P. Hedrick. 2006. Inheritance of *Myxobolus cerebralis* resistance among F1-generation crosses of whirling disease resistant and susceptible rainbow trout strains. Journal of Aquatic Animal Health 18:109-115.

Schisler, G. J., and E. P. Bergersen. 2002. Evaluation of risk of high elevation Colorado waters to the establishment of *Myxobolus cerebralis*. Pages 33-41 *in* J. L. Bartholomew and J. C. Wilson, editors. Whirling disease: reviews and current topics. American Fisheries Society, Symposium 29, Bethesda, Maryland.

Thompson, K. G., R. B. Nehring, D. C. Bowden, and T. Wygant. 1999. Field exposures of seven species or subspecies of salmonids to *Myxobolus cerebralis* in the Colorado River, Middle Park, Colorado. Journal of Aquatic Animal Health 11: 312-329.

Vincent, E. R. 1996. Whirling disease and wild trout: the Montana experience. Fisheries (Bethesda) 21: 32-34

Vincent, E. R. 2002. Relative susceptibility of various salmonids to whirling disease with emphasis on rainbow and cutthroat trout. Pages 109-115 *in* J. L. Bartholomew and J. C. Wilson, editors. Whirling disease: reviews and current topics. American Fisheries Society, Symposium 29, Bethesda, Maryland.

Wagner, E. J., C. Wilson, R. Arndt, P. Goddard, M. Miller, A. Hodgson, R. Vincent, and K. Mock. Evaluation of disease resistance of the Fish Lake-DeSmet, Wounded Man, and Harrison Lake strains of rainbow trout exposed to *Myxobolus cerebralis*. Journal of Aquatic Animal Health 18: 128-135.

**Field Performance Evaluations: Comparison of GR and Tasmanian strain rainbow trout as catchable plants in two put-and-take waters in Colorado.**

## INTRODUCTION

The GR strain rainbow trout has been identified as a strain that is highly resistant to *M. cerebralis* (Hedrick et al. 2003, Schisler et al. 2006). Other characteristics observed in laboratory experiments such as aggressive feeding behavior and rapid growth suggests that the strain may be useful as a catchable rainbow trout product. The GR rainbow trout appears to be a suitable replacement for other domestic strains used in Colorado from the standpoint of hatchery performance. However, performance of the GR strain compared to other standard domestic strains after it has been released to receiving waters has not yet been evaluated. In Colorado, approximately 3.2 million catchable-sized rainbow trout are produced per year for recreational angling. Catchable production fish raised for put-and-take use in Colorado are usually Tasmanian or Bellaire strain rainbow trout. A study was designed to compare the GR rainbow trout with another standard domestic strain, the Tasmanian rainbow trout, as a catchable product in typical put-and-take waters.

## METHODS

*Hatchery Rearing* - GR and Tasmanian strain rainbow trout were reared in parallel from egg to catchable size at Chalk Cliffs Rearing Unit, a facility that is positive for *M. cerebralis* (See Previous Section; Hatchery Performance Evaluations: Performance of a whirling disease resistant rainbow trout strain at two *Myxobolus cerebralis*-positive trout rearing facilities). Eggs from both strains were hatched during the same week, and the conditions were identical for both strains throughout the rearing period of 16 months.

*Stocking and Creel Surveys* - Two front-range reservoirs, Flatiron and Pinewood reservoirs, were used as study locations for the catch and return to creel portion of the experiment. Both reservoirs are typical of coolwater reservoirs on the front range of Colorado in which fish are stocked for immediate recreational angling and harvest. These reservoirs, located northwest of Berthoud, Colorado, are typical high-use locations managed as put-and-take fisheries. Historical stocking rates have been from 15,000-30,000 catchable rainbow trout per year in each of the reservoirs. Pinewood Reservoir has also been stocked with 200-800 tiger muskie (*Esox lucius x Esox masquinongy*) fingerlings per year.

Fish for this live-release experiment were reared at Chalk Cliffs Rearing Unit (See previous section, Hatchery Performance Evaluations: Performance of a whirling disease resistant rainbow trout strain at two *Myxobolus cerebralis*-positive trout rearing facilities). A reduced number of fish were stocked into the reservoirs for the purposes of this experiment. Fish of each strain were stocked per the standard stocking schedule for the reservoirs every two to four weeks from the beginning of April until the end of June. Equal numbers of each strain were stocked into each reservoir during each stocking event, with the exception of the last plant (Table 3.3).

Table 3.3. GR and Tasmanian strain rainbow trout stocked from April through June, 2006, at Flatiron and Pinewood reservoirs.

| | **Flatiron Reservoir** | | **Pinewood Reservoir** | |
|---|---|---|---|---|
| | GR | Tasmanian | GR | Tasmanian |
| April 5, 2006 | 1000 | 1000 | 1000 | 1000 |
| May 4, 2006 | 874 | 874 | 874 | 874 |
| May 17, 2006 | 700 | 700 | 700 | 700 |
| June 7, 2006 | 700 | 700 | 700 | 700 |
| June 28, 2006 | 861 | 861 | 612 | 362 |
| Totals | 4135 | 4135 | 3886 | 3636 |

**Error! Not a valid link.**One half of the fish stocked on each occasion were of the GR strain, and the other half were of the Tasmanian strain. The fish had been marked prior to stocking with fin clips to identify the fish by strain, GR fish with adipose clips, and Tasmanian stain with pelvic fin clips.

A creel schedule was created in which anglers were surveyed on both weekend days of every week, and two randomly chosen weekdays per week for the months of April through August. Two weeks at the end of March, 2006, were also included in the survey, prior to the official start of the study, to familiarize the creel clerks with the process. Angler counts were conducted five times daily throughout the daylight hours. Angler interviews were conducted between count times. Because the strains were differentially marked with fin clips, the creel clerk could easily distinguish between the two strains and catch estimates were made for both strains. During the angler interviews, additional questions were asked to determine if there was an angler preference between the strains. If there was a preference, the anglers were asked to describe which characteristics were most important in making that determination.

*Supplemental Questionnaire Information* - Supplemental questions were also asked to provide information on other unrelated topics. These were questions requested by management or hatchery section personnel. One question was an inquiry as to the number of days the angler ice-fished in the previous year. This was asked because relatively little statewide data exists on the proportion of anglers in Colorado that participate in ice fishing. The results of this question were intended to augment data released in recent statewide angler preference survey "2004 Colorado Angler Survey Summary Report-Aquatic Wildlife Section Special Report 06-1 March 2006", in which questions regarding ice fishing were inadvertently excluded.

A second question was asked to determine if there was a preference for fish flesh color in catchable rainbow trout. This was asked because some preliminary work conducted by the Colorado Division of Wildlife Hatchery Section with Roxanthin-enhanced feed demonstrated that flesh color in catchable-sized trout could be changed from white to pink for nominal cost per pound (Matt Schehrer, Mt. Shavano hatchery manager, personal communication).

*Holdover Evaluation* - Boat-mounted electroshocking was conducted at the end of the summer fishing season to evaluate fish remaining of each strain. Proportions of fish remaining were compared between strains. Samples were collected from surviving fish for analysis with pepsin-trypsin digest to determine myxospore counts in holdover fish that would potentially contribute to amplification of infection in the reservoirs.

## RESULTS

*Hatchery Rearing* - The GR strain rainbow trout developed an average myxospore count of 5,175 (SD = 7,644) and the Tasmanian rainbow trout developing an average myxospore count of 48,883 (SD = 50,825) after 10 months of growth at the Chalk Cliffs rearing facility. Growth in the GR strain rainbow trout was significantly faster than in the Tasmanian rainbow trout with the GR strain reaching an average length of 282 mm (11.1 inches) and the Tasmanians reaching an average length of 234 mm (9.2 inches) at the time the first fish were stocked from the facility.

*Catch by Strain* - Raw data indicated that a much higher percent of the GR rainbow trout were captured than the Tasmanian rainbow trout (Figures 3.5 and 3.6). This was especially true during the months that stocking occurred. After stocking was halted, numbers of fish captured of each strain were more closely matched. Total catch reported was 58.5% higher for the GR strain than the Tasmanian strain in Pinewood Reservoir. Total reported catch was 22.1% higher for the GR strain than the Tasmanian strain in Flatiron Reservoir.

Figure 3.5. Catch data from creel reports for number of rainbow trout caught by strain at Flatiron Reservoir.

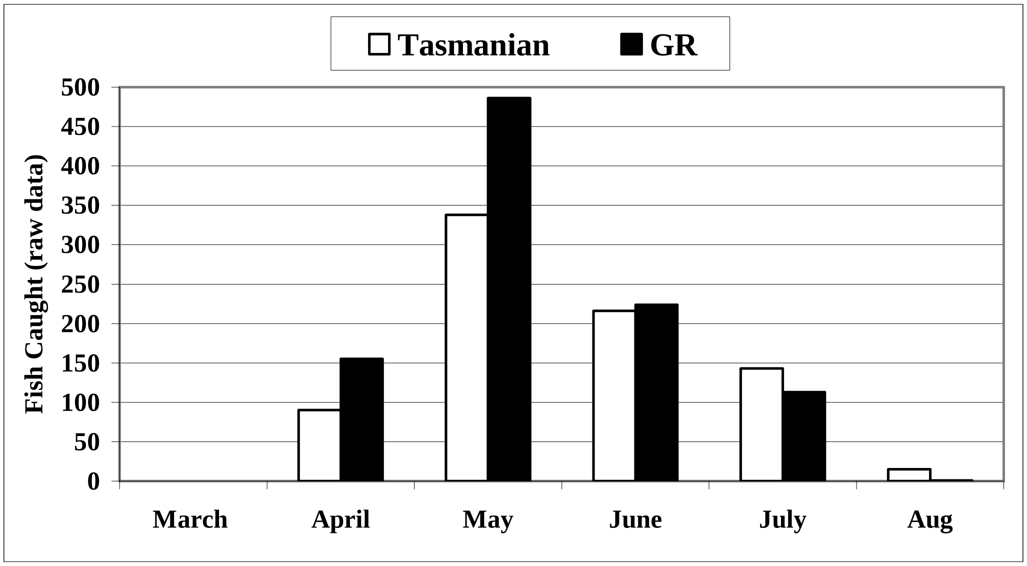
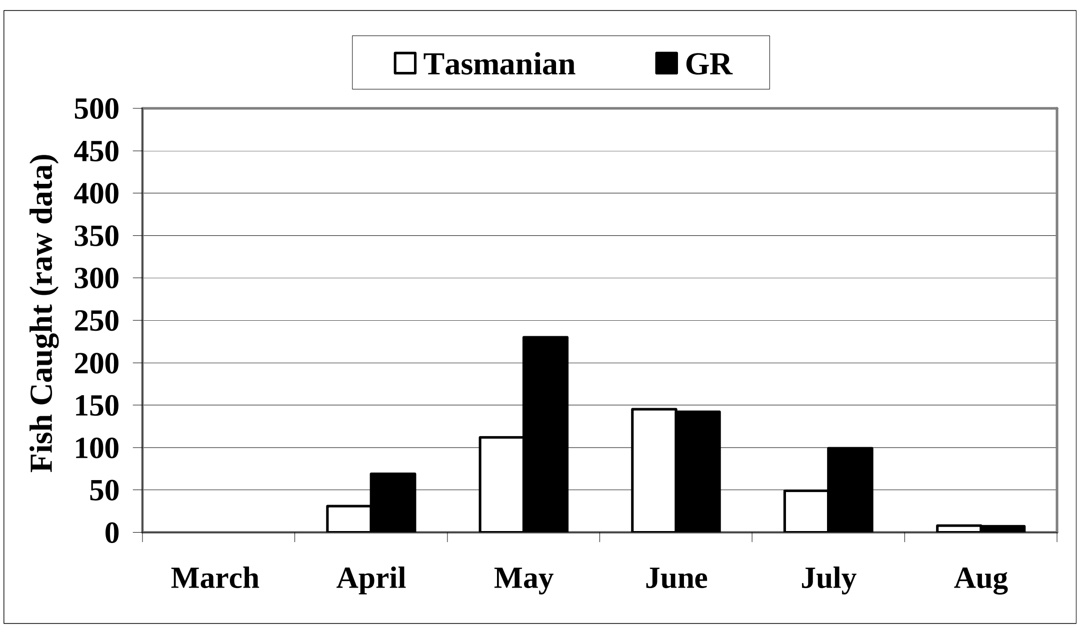
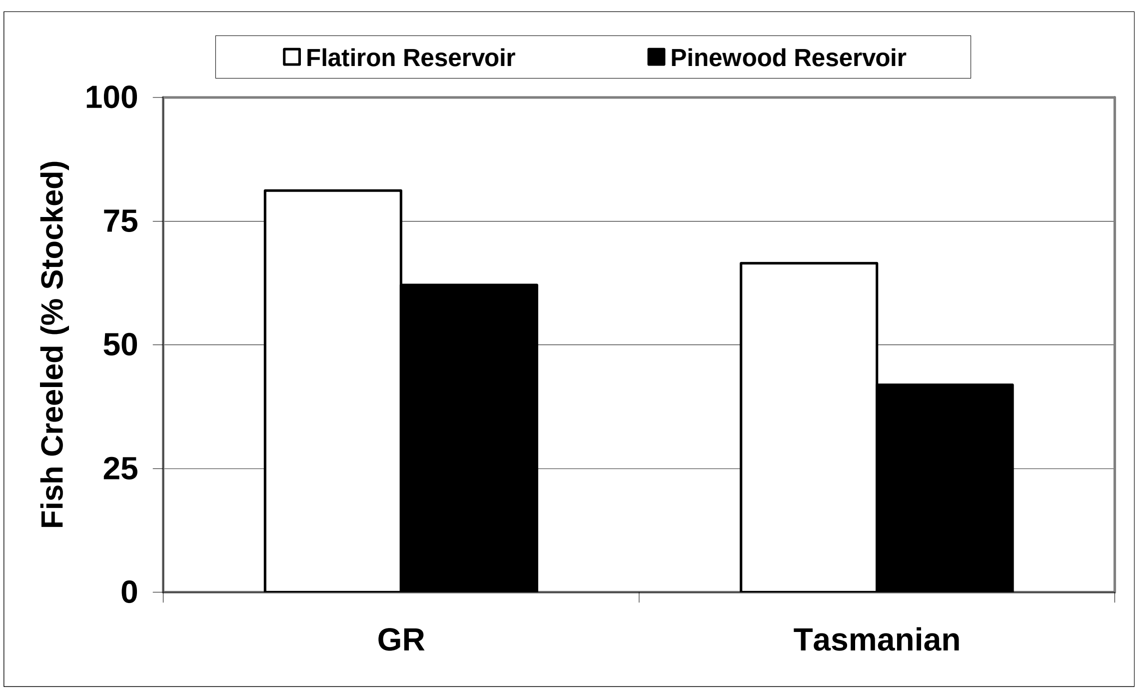



Figure 3.6. Catch data from creel reports for number of rainbow trout caught by strain at Pinewood Reservoir.



*Creel Survey Analysis* - As an ancillary part of this project, a new creel survey program was developed based on the Colorado Division of Wildlife's DOS-based version of C-SAP. The original C-SAP program was last updated in February of 1990. The software has become increasingly difficult to run on newer computers. The data entry portion of the program is problematic and interpretation of the reports is complicated. Accurate creel information and efficient data entry were necessary for this particular project and the Colorado Division of Wildlife as a whole would benefit from an updated format of the program. As a result, efforts were initiated to create a Windows-based version of the original C-SAP program. All estimates used in the programming of the new C-SAP program are the same as in the prior version. Several releases of the program have been made over the last year, as improvements in the code and reports have been made. Data entered in the fall of 2006 into the program was run, for the purposes of this report, in the newest release, dated June 26, 2007. Options chosen for the output included selection of all available species, selection of "Statistical Method 1" and de-selection of the finite population correction factor. Thorough documentation and user's manual information describing the available options and nuances of the program will be provided in the 2008 Federal Aid Report, when the final updates are expected to be complete. Report results for Flatiron Reservoir (water code 54851) and Pinewood Reservoir (water code 55928) are attached as Appendix I. Fish returns by strain were compared with numbers of fish stocked to determine the rate of return for each of the two strains at both reservoirs (Figure 3.7).

Figure 3.7. Proportion of fish returned to creel by strain for Flatiron and Pinewood reservoirs in 2006.



*Angler Preference* - Responses for each question were summarized separately. Not all questions were answered by all contacts, so number of respondents is not the same for each question. When asked about strain preference based on the fin clip marks, 22.6% of the 1,831 respondents chose the GR rainbow, compared with 3.2% that chose the Tasmanian rainbow. The remaining 74.2% had no preference. When asked about which characteristics they preferred with regard to the two strains, fighting ability was reported as the most important by 25.0% of 1,843 respondents. Only 1.8% reported that fish size was the most important characteristic. Catch rate was regarded as most important by 1.2% of the respondents, and appearance was most important to 0.3% of the respondents.

Figure 3.8. Angler preference by strain, as defined by fin clip, for Flatiron and Pinewood reservoirs in 2006.

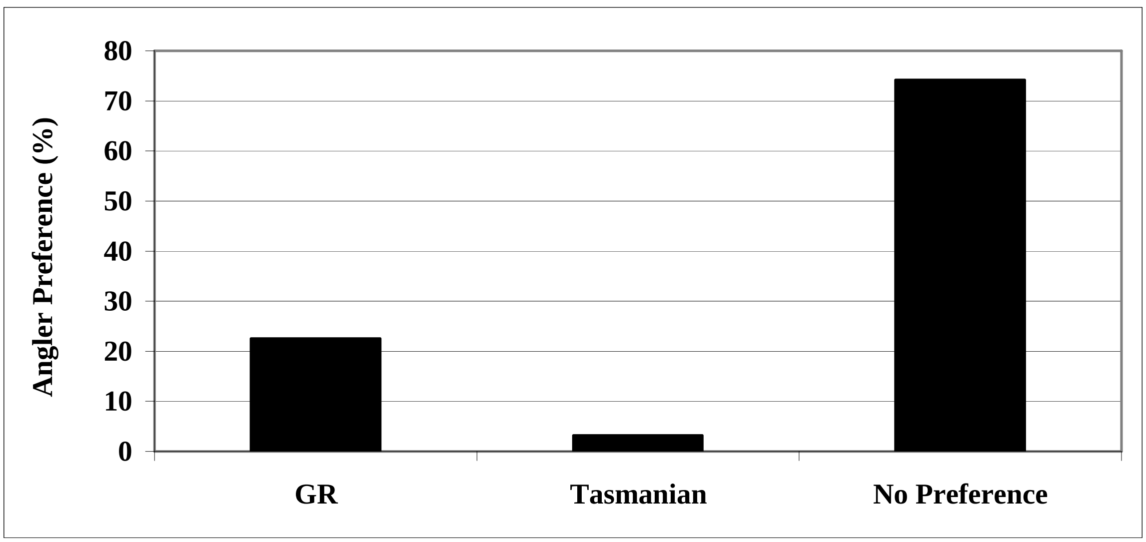
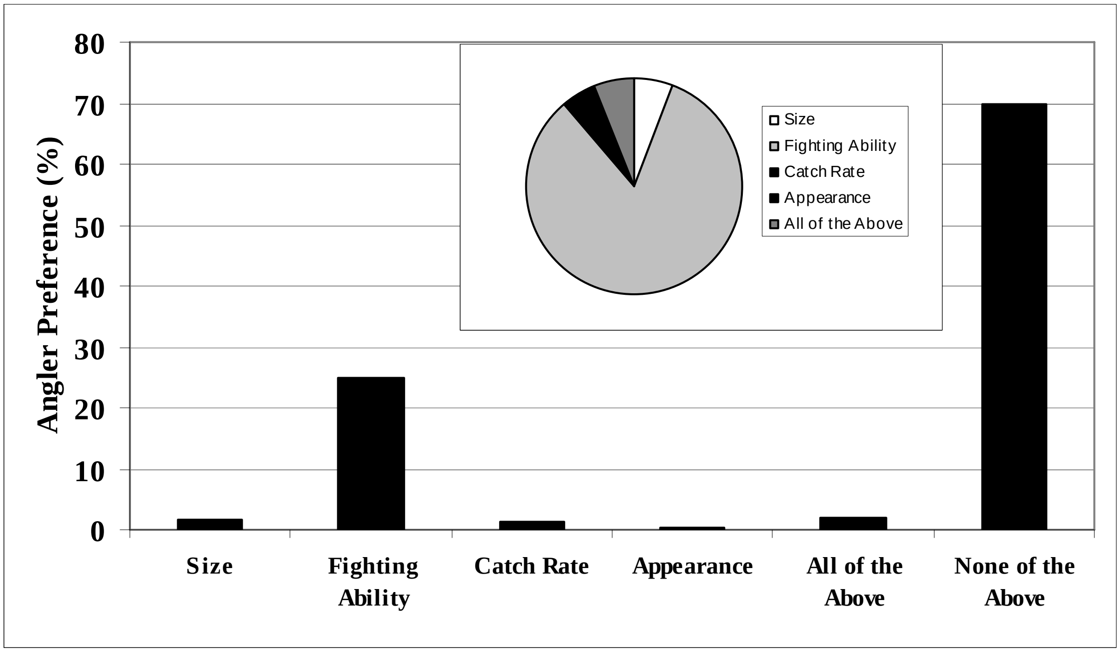


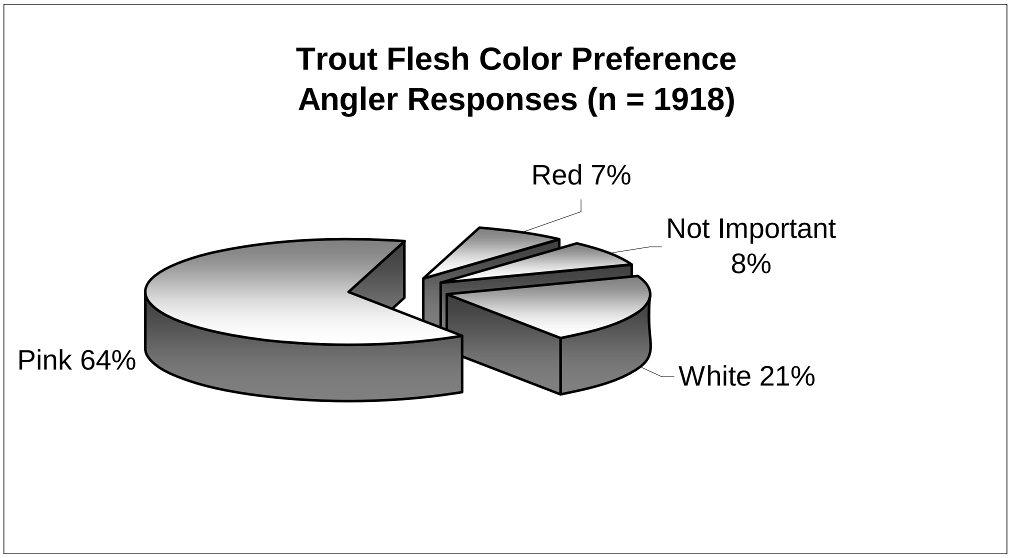
Figure 3.9. Characteristics of fish contributing to angler preference at Flatiron and Pinewood reservoirs in 2006. The bar graph reflects all responses, including for anglers that had no preference. The pie chart describes preference (percent respondents) only for anglers that indicated that they had a preference.




*Other Questionnaire Responses* - Angler participation in ice–fishing among the respondents was low. Of the 1,880 respondents, only 113 (6.0%) had ice-fished in the previous year. Average number of days fished per person that participated in ice-fishing was 5.06.

When asked which color flesh was preferred, the anglers overwhelmingly chose pink flesh as the color of choice. Of the 1,918 respondents, 1,221 preferred pink flesh, 407 preferred white, and 141 preferred red. Only 149 anglers had no preference.

Figure 3.10. Angler preference for trout flesh color, Flatiron and Pinewood reservoir questionnaire results, 2006.




*Holdover Evaluation* -Low numbers of both strains were found during the end-of-season electrofishing samples. In Flatiron Reservoir, only two GR and three Tasmanian rainbow trout were collected. In Pinewood Reservoir, only six GR and 26 Tasmanian rainbow trout were collected. These front-range reservoirs are subject to intense fishing pressure that typically results in seasonal depletions of stocked fish. It is notable, however, that more Tasmanian rainbow trout remained in both reservoirs at the end of the experiment. These results support the creel survey data, which indicated that the GR rainbow trout were caught more readily than the Tasmanian strain. Myxospores found in the Tasmanian rainbow trout averaged 122,074 (SD = 70,628) per fish, while those found in the GR rainbow trout averaged 210 (SD = 595) per fish at the conclusion of the experiment. In reservoirs where large numbers of holdover fish or mortality occurs, contribution of myxospores to the system could be quite different for the two strains. This could occur due to both the higher holdover rate and higher average myxospore count in the Tasmanian rainbow trout.

## DISCUSSION

Rapid growth, high return to creel and angler satisfaction, and low myxospore production all support the conclusion that the GR strain could be a useful replacement for other domestic strains used in Colorado for catchable rainbow trout production. Additional evaluations are ongoing at other state trout rearing facilities, and additional creel survey work will be conducted to validate these conclusions. In this evaluation, the GR strain were larger on average than the Tasmanian strain fish when stocked. This was unavoidable because of the rapid growth of the GR strain in the rearing facilities prior to stocking. While the anglers did not perceive fish size to be a major factor in preference between the two strains, it is possible that the larger size of the GR fish effected their perception of the strain.

Lower returns were observed with both strains in Pinewood Reservoir. Pinewood Reservoir is a little farther for fishermen to travel and the camping facilities are not as extensive, which could influence angler use. The outlet of Pinewood reservoir is also not conducive to retaining fish in the reservoir, with a vortex-like outlet structure having the potential to draw out fish. The principle difference between the two reservoirs, however, is the presence of large numbers of tiger muskies in Pinewood Reservoir. The impact of these fish on the catchable and fingerling plants in the reservoir is unknown, although predation on hatchery-produced trout would presumably be quite high. If the differences in return to creel between the two reservoirs were entirely due to tiger muskie predation, an average of 21.9% fewer trout would have been harvested due to their presence. Of course this assumes that the other factors described above are not influencing return positively or negatively, which is unlikely.

A follow-up experiment has been started at Pinewood and Flatiron reservoirs with the GR-Harrison (75:25) cross to determine if this slightly outbred strain will perform as well as the pure GR strain. Procedures are the same as in this experiment, and it will provide additional information on the relative return of these resistant rainbow trout compared to other domestic strains currently in use.

## REFERENCES

Hedrick R. P., T. S. McDowell, G. D. Marty, G. T. Fosgate, K. Mukkatira, K. Myklebust, and M. El-Matbouli. 2003. Susceptibility of two strains of rainbow trout (one with suspected resistance to whirling disease) to *Myxobolus cerebralis* infection. Diseases of Aquatic Organisms 55: 37-44.

Schisler, G. J., Myklebust, K. A., and R. P. Hedrick. 2006. Inheritance of resistance to *Myxobolus cerebralis* among F1-generation crosses of whirling disease resistant and susceptible strains of rainbow trout. Journal of Aquatic Animal Health 18:109-115.

Schisler, G. J., and P. J. Schler. 2006. Performance of Hofer rainbow trout compared with other domestic stocks in Colorado trout rearing facilities. 12th Annual Whirling Disease Symposium. February 9&10, 2006. Denver, Colorado.

**Job No. 4. Whirling Disease Resistant Wild Strain Brood Stock Development and Evaluation**

**Job Objective:** These experiments are designed to develop and evaluate "wild" strain whirling disease resistant rainbow trout for reintroduction into areas where self-sustaining populations have been lost due to whirling disease.

## INTRODUCTION

One of the highest priorities for whirling disease research is to ultimately re-establish wild rainbow trout populations in locations where they have been destroyed due to whirling disease. Some locations of particular interest are the Gunnison, South Platte, Yampa, Colorado, Rio Grande, and Fryingpan rivers. All of the stocking and sampling events were conducted by, or in cooperation with the respective area fisheries biologists. Dan Kowalski, area biologist for the Gunnison River, Jeff Spohn, area biologist for the South Platte River, and Billy Atkinson, the area biologist for the upper Colorado and Yampa rivers, were all instrumental in the collection of the data reported herein.

A few locations have been stocked with fingerling fish of various GR-cross varieties as pilot experiments, to determine if these strains would have any survival success. A small-scale survival experiment was conducted on an artificial stream channel on the South Platte River upstream of Spinney Mountain Reservoir in 2004 and 2005. Higher survival rates were observed among the F1 generation fish than either the pure GR or pure CRR rainbow trout strains in this experiment (Schisler 2006). Additional GR-Harrison crosses were stocked upstream of Antero Reservoir on the South Platte River in 2006.

A larger-scale experiment was initiated in 2004 on the Gunnison River. Results of that effort, from samples collected in the fall of 2005, indicated that the F1 strain survive as well as the pure CRR strain when stocked as four-inch fingerlings. Stocking efforts in that location continue through 2007.

GR-CRR fingerlings have been stocked into the Yampa River, and larger sub-catchable sized GR-CRR fish have been stocked into the upper Colorado River, in an attempt to help re-establish wild rainbow trout populations there.

Additional F1 and B2 variety fish were stocked into locations where re-establishment of wild rainbow trout populations is desirable such as the Rio Grande and Fryingpan Rivers. The survival and performance of fish stocked in these locations are not being rigorously evaluated because of limited resources and personnel. However, any successful recruitment of wild rainbow trout in the future may be evaluated as to origin through the use of genetic markers that identify the offspring of the GR-strain fish. The following is a summary of live-release trials intended to re-establish wild rainbow trout populations.

## METHODS

*Gunnison River*

**2004-2005**

F1 (GR-CRR) fish were hatched on March 14, 2004, at the FRH and marked with red visible implant elastomer (VIE) marks after reaching 76-102 mm (3-4 inches) in length. Pure CRR fish were hatched at the Colorado Division of Wildlife Rifle Falls Hatchery (RIF) on March 13, 2004, and similarly marked with green VIE marks. The two strains were given these marks to distinguish between the strains during population estimates. In this experiment, 10,104 pure CRR and 10,115 CRR-GR rainbow trout were stocked as 13.6 cm and 11.9 cm fingerlings, respectively into a 2,823 m section of the Gunnison Gorge at Ute Park on October 21, 2004. The fish were mixed together prior to stocking to prevent bias due to handling, then spread throughout the stream section using helicopter plants.

**2005-2006**

Growth, survival, and infection severity of the two strains planted in 2004 were evaluated from samples collected during the annual population estimate, conducted on September 27, 2005. Estimates were conducted using mark-recapture sampling with boat-mounted electroshocking gear. All rainbow trout were carefully examined for evidence of VIE marks. A subsample of fish with red (F1 fish) and green (pure CRR fish) VIE marks were collected for myxospore evaluation. Infection severity was evaluated by myxospore count analysis on seven pure CRR and 10 F1 fish.

Because of the low survival of the previous year's plant, larger fish were stocked in 2005 to potentially reduce predation. B2 [GR-CRR (25:75)] fish, hatched on April 10, 2005 at the Research hatchery, were marked with an adipose clip after reaching 7.6 – 10.0 cm (3-4 inches). Pure CRR hatched at RIF on March 28, 2005, were similarly given right pelvic clip. Stocking was conducted a second time at Ute Park using 5,000 pure CRR and 5,000 B2 fish on November 17, 2005. Fish were again mixed together immediately prior to stocking. As in 2004, fish were lowered into the stream section using a helicopter. However, during this stocking event, all of the fish were stocked into a holding cage and allowed to acclimate for 30-45 minutes prior to being released. All fish were released in the same location at the Ute Park station.

**2006-2007**

Population estimates were conducted again on September 26, 2006, using the same methods as in 2005. Particular attention was given to any rainbow trout captured to identify VIE marks from the 2004 plant, and fin clips from the 2005 plant. Many rainbow trout were captured that did not show any evidence of fin clips. This could have been due to either re-growth of fins, or some fish being stocked without receiving the appropriate clip. In order to determine the strain of the unmarked fish, a sample of these fish were collected to be tested with the AFLP technique (see Appendix II). Additional fish with obvious fin clips were also collected. These fish were also tested for severity of *M. cerebralis* infection with myxospore counts obtained from the PTD technique.

On November 20, 2006, F1 fish were again stocked in the Ute Park section of the Gunnison River. This was to determine if the slightly larger F1 strain fish would perform better than the first (2004) plant of F1 fish. The pure CRR fish were not marked in this plant, while the F1 fish were again given an adipose clip. The fish were stocked in the same manner as those in 2005, with fish allowed to acclimate in holding cages before release.

*South Platte River*

In September, 2005, 800 each of pure GR and GR-CRR rainbow trout (10.0-13.0 cm; 4-5 inches) were released into a newly created channel on the South Fork of the South Platte River, downstream of the town of Hartsel. This section had been stocked in August, 2005, with 2,250 McConaughy rainbow trout (10.0-13.0 cm; 4-5 inches). The GR rainbow trout were fin clipped with an adipose clip, the GR-CRR rainbows were given a right pelvic fin clip, and the McConaughy rainbow trout were given a left pelvic fin clip. A two-pass removal estimate was conducted on September 21, 2006 on a 100 meter (330 ft, Station 2) section, and a 78 meter (255 ft, Station 4) section using bank-mounted electroshocking gear.

On March 29, 2006, a total of 13,759 fingerling rainbow trout of the GR-Harrison variety were stocked upstream of Antero Reservoir on the Knight-Imler State Wildlife Area. A two-pass removal estimate was conducted on September 21, 2006 on a 163 meter (536 ft) section using bank-mounted electroshocking gear. Estimated numbers of fish by species were calculated for general survey purposes using all fish captured. A separate estimate was calculated based only on fish marked for this study.

*Yampa River*

Two thousand of the B2 [GR-CRR (25:75)] variety were stocked into the Yampa River, downstream of Stagecoach Reservoir, on May 26, 2006. The fish were an average of 66 mm (2.6 inches) at time of stocking. Another group of 5,500 fish of the same size were stocked in Service Creek on May 31, 2006. On December 7, 2006, population estimates were conducted on an 86 meter (282 ft) section downstream of Stagecoach Reservoir. Length and weights were recorded to evaluate growth rates in this highly productive location. Fish samples from both locations, consisting of stocked fish and fish originating from natural reproduction, were collected for PTD analysis.

*Upper Colorado River*

This section of river is known to be heavily infected with *M. cerebralis.* Natural recruitment of rainbow trout has not occurred since the mid-1990's, and even brown trout fingerlings have exhibited severe signs of whirling disease in the reaches immediately downstream of Windy Gap Reservoir. However, brown trout numbers have increased over the past decade, and fingerling plants of Colorado River Rainbow trout to augment the rainbow trout population have not had high survival.

Because of the concern about heavy brown trout predation on fingerling rainbow trout plants in the upper Colorado River, a decision was made to stock larger fish in this location. F1 strain (GR-CRR) were selected for this trial. Long term survival and growth evaluations were also considerations for this experiment, so fish were reared to 9.5 inches in length before stocking. Each fish was measured to the nearest 0.5 cm, and marked with an individually numbered fine filament Floy anchor tag. Half of the tags used were grey, and the other half were pink. This was done in an effort to determine if tag color had any effect on survival. Three thousand of these F1 fish were then stocked on June 2, 2006, in the upper Colorado River between Windy Gap Reservoir and the town of Hot Sulphur Springs, just upstream of Byers Canyon.

In November of 2006, a standard two-pass removal population estimate was conducted on a 305 meter (1000 ft) section of the upper Colorado River at the Chimney Rock station using bank-mounted electroshocking gear. Marked fish were estimated separately for the purposes of this experiment.

*Other Locations*

Fingerling fish of the F1 and B2 varieties were stocked into the Fryingpan River and the South Fork of the Rio Grande and in Beaver Creek, a tributary of the South Fork. These plants were made in an attempt to re-establish wild rainbow trout populations. A rigorous evaluation was not attempted at these locations.

## RESULTS

*Gunnison River*

The 2005 population estimate indicated that survival of both groups of fish stocked in 2004 was relatively low, with only 12 of the pure CRR, and 24 of the F1 (GR-CRR) fish being found in the 2,375 m sampling area. The sampling resulted in an estimate of 9.9 ± 19.9 fish/km (16.0 ± 32.0 fish/mile) or an estimated 23.5 ± 47.5 fish of the CRR strain in the sampling reach. The estimates for F1 strain were 13.7 ± 14.3 fish/km (22 ± 23 fish/mile) or an estimated 32.3 ± 33.4 fish in the sampling reach. The average total length for CRR fish was 24.8 cm, and 28.3 cm for the F1 fish.

All of the pure CRR fish were found to be infected, with an average spore count of 124,603 (SD= 129,406). Only six of the 10 F1 fish were found to be infected, with and average spore count of 4,055 (SD = 8,336). Proc GLM in SAS system software was used to test for differences in myxospore counts between strains, which resulted in highly significant differences ($F_{[1,16]}$=8.88, $P$ = 0.0094).

The population estimate conducted in 2006 resulted in an average of 1.24 fish ± 0.0 fish/km (2 ± 0 fish/mile) of the pure CRR strain remaining from the 2004 plant. Similarly small numbers of the F1 strain were found from the 2004 plant, with an average of 1.86 ± 1.2 fish/km (3 ± 2 fish/mile).

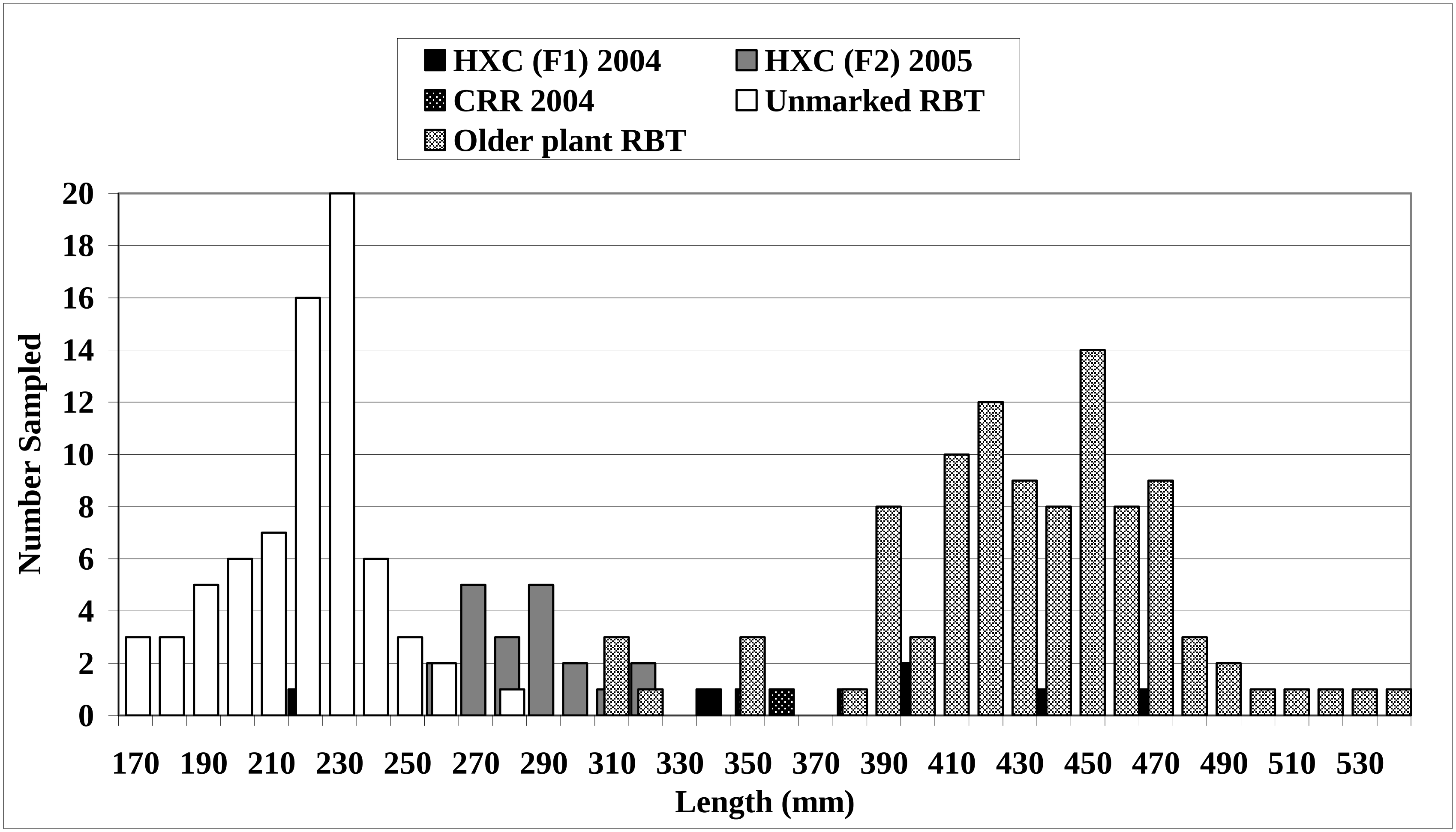
The loss of marks (regeneration of fin clips or poor marking) in fish stocked in 2005 resulted in a difficult evaluation of their survival. AFLP results correctly identified the one fish collected with a good pelvic fin clip as pure CRR fish (Table 4.1). The fish collected with good adipose clips were also correctly identified as GR-CRR crosses. Of the 10 fish with no marks from the 2005 plant that were collected and evaluated with AFLP, six were identified as pure CRR, and four were identified as GR-CRR crosses. Applying the 60:40 ratio to all of the fish captured in the size class of fish 170 to 280 mm that did not have visible marks (in addition to the estimate for the fish that actually retained their marks) resulted in a total estimate of 32.9 fish/km (53 fish/mile) of the pure CRR strain and 21.8 fish/km (35 fish/mile) of the B2 strain, originating from the 2005 plant.

An average of 83,929 myxospores (SD = 149,719) was found in the pure CRR fish planted in 2005, including the fish identified as such by AFLP analysis. The average myxospore count among B2 fish, including those identified as GR-CRR crosses by AFLP, was 40,480 (SD = 48,121).

Table 4.1. Myxospore counts and classification of age 1+ and 2+ rainbow trout based on fin clips and AFLP analysis in the Gunnison River, 2006.

| SAMPLE | FIN CLIP | SPORE COUNT | STRAIN | AFLP CLASS |
|---|---|---|---|---|
| 1 | Age 2+ fish | DNA sample only | Unknown | CRR |
| 2 | Pelvic | 368,667 | CRR | CRR |
| 3 | Adipose | 58,372 | B2 | B2 |
| 4 | Adipose | 15,361 | B2 | B2 |
| 5 | Adipose | 52,228 | B2 | F2 |
| 6 | Adipose | 0 | B2 | B2 |
| 7 | Adipose | 175,117 | B2 | B2 |
| 8 | Adipose | 36,867 | B2 | F2 |
| 9 | Adipose | 0 | B2 | B2 |
| 10 | Adipose | 82,950 | B2 | B2 |
| 11 | Adipose | 0 | B2 | B2 |
| 12 | Adipose | 76,806 | B2 | F2 |
| 13 | None | 218,833 | Unknown | CRR |
| 14 | None | 0 | Unknown | CRR |
| 15 | None | 0 | Unknown | CRR |
| 16 | None | 21,883 | Unknown | B2 |
| 17 | None | 0 | Unknown | CRR |
| 18 | None | 0 | Unknown | CRR |
| 19 | None | 35,350 | Unknown | B2 |
| 20 | None | 11,783 | Unknown | B2 |
| 21 | None | 0 | Unknown | B2 |
| 22 | None | 0 | Unknown | CRR |

Figure 4.1. Rainbow trout population estimates for the Gunnison River, Ute Park section, 2006.



*South Platte River*

Large numbers of GR-Harrison fish were found in the sampled section of the Knight-Imler SWA. During the two-pass removal estimate, 160 fish of the spring plant were captured in the first pass, and three in the second pass. This resulted in a population estimate of 998 fish per km (1,606 fish per mile). Samples collected for *M. cerebralis* testing resulted in identification of the parasite in only two of the 10 samples. Only one myxospore was found in one fish, and only five myxospores in one other fish. Average myxospore counts were 1,010, collectively, for the ten fish.

*Yampa River*

Growth in the B2 fish stocked in the Yampa River and Service Creek during the May, 2006, plant was very good (Table 4.2). Myxospore counts in the B2 were higher than the wild rainbow trout downstream of Service Creek, which would have been exposed to the parasite for fewer total degree days and will likely develop higher spore counts as they experience more degree-days. The average myxospore counts in the B2 fish collected below Service Creek, at 133,825 myxospore per fish, were quite similar to those observed in B2 fish in the 2006 laboratory experiments, which averaged 125,168 per fish.

Table 4.2. Growth and myxospore counts for wild CRR and stocked B2 fish (stocked May, 2006) downstream of Stagecoach Reservoir and Service Creek in December, 2006.

**Below Service Creek (Wild)- Lot 1**

| Fish | Length (mm) | Weight (g) | Myxospores |
|---|---|---|---|
| 1 | 91 | 9 | 0 |
| 2 | 71 | 4 | 114,467 |
| 3 | 89 | 8 | 0 |
| 4 | 76 | 5 | 245,767 |
| 5 | 59 | 3 | 228,933 |
| 6 | 80 | 6 | 74,067 |
| 7 | 83 | 7 | 99,317 |
| 8 | 80 | 6 | 1,683 |
| 9 | 67 | 3 | 6,733 |
| 10 | 68 | 3 | 0 |
| 11 | 62 | 2 | 141,400 |
| Average | 75 | 5 | 82,942 |

**Below Stagecoach (Wild)- Lot 3**

| Fish | Length (mm) | Weight (g) | Myxospores |
|---|---|---|---|
| 1 | 114 | 18 | 0 |
| 2 | 110 | 18 | 0 |
| 3 | 106 | 14 | 0 |
| 4 | 115 | 19 | 13,467 |
| 5 | 111 | 16 | 0 |
| 6 | 148 | 32 | 0 |
| Average | 117 | 19 | 2,244 |

**Below Stagecoach Reservoir B2 (GR:CRR) - Lot 2**

| Fish | Length (mm) | Weight (g) | Myxospores |
|---|---|---|---|
| 1 | 159 | 52 | 0 |
| 2 | 160 | 58 | 0 |
| 3 | 186 | 98 | 0 |
| 4 | 134 | 32 | 0 |
| 5 | 164 | 56 | 0 |
| 6 | 185 | 85 | 0 |
| 7 | 204 | 118 | 0 |
| 8 | 200 | 110 | 0 |
| 9 | 170 | 76 | 0 |
| 10 | 140 | 37 | 0 |
| 11 | 201 | 95 | 0 |
| Average | 173 | 74 | 0 |

**Below Service Creek B2 (GR:CRR) - Lot 4**

| | Length (mm) | Weight (g) | Myxospores |
|---|---|---|---|
| 1 | 167 | 47 | 23,567 |
| 2 | 180 | 68 | 244,083 |
| 3 | 191 | 85 | 1,683 |
| 4 | 158 | 45 | 5,050 |
| 5 | 165 | 58 | 40,400 |
| 6 | 205 | 104 | 600,950 |
| 7 | 197 | 95 | 244,083 |
| 8 | 181 | 65 | 82,483 |
| 9 | 212 | 100 | 35,350 |
| 10 | 226 | 145 | 60,600 |
| Average | 188 | 81 | 133,825 |

*Upper Colorado River*

Eighty-three fish from the June, 2006, stocking event were found during the November, 2006 population estimates. The fish had grown an average of 46 mm (1.8 inches), SD = 10 mm. The extrapolated estimate resulted in 272 fish per km (438 fish per mile) of the planted F1 fish. If it is assumed that the fish were distributed evenly along this 14 km section of river from Windy Gap Reservoir down to Byers Canyon, very high survival has occurred for the first six months post-stocking. Continued monitoring of these marked fish as well as wild rainbow trout reproduction and recruitment evaluation will occur over the next several years in the upper Colorado River.

## DISCUSSION

These results are encouraging, and demonstrate that the F1 generation fish can survive at least as well as the pure CRR rainbow trout when planted as fingerlings. It also demonstrates that the myxospore counts produced after stocking are much lower in the F1 fish. The high survival and good post-stocking growth of the larger plant in the upper Colorado River is particularly encouraging, as it is quite possible that these fish are capable of surviving and reproducing in large numbers when they reach sexual maturity. High densities of brown trout continue to contribute to the poor survival of the stocked rainbow trout in the Gunnison River. Evaluations of the 2004 through 2006 plants will continue over the next several years, and genetic markers (See Appendix II) will be used to test any surviving fingerlings to identify any rainbow offspring with GR origins.

The myxospore counts in B2 fish released into the wild were similar to the results found in the laboratory experiments. It is unfortunate, but not unexpected, that fish with higher proportion of CRR to GR strain genetic background would be less resistant to infection from the parasite. This reinforces the notion that allowing natural selection of the resistant offspring of the F1 generation fish in the wild may be a more effective method to producing sufficient resistance and wild behaviors than creating these subsequent crosses artificially.

The laboratory results for the GR-Harrison strain, and early live-release outcome for this strain upstream of Antero Reservoir suggest that it could be very useful in locations that are positive for *M. cerebralis.* Their high resistance and excellent survival in this limited evaluation is encouraging and the strain will be more extensively evaluated in the future.

The resistant strain evaluations are still in the early stages with regard to re-establishment of wild rainbow trout populations. Work conducted in the next several years will be very important to determine which combinations of the GR and wild strains are effective for establishing self-sustaining rainbow trout populations.

**Job No. 5. Technical Assistance**

**Job Objective:** Provide information on impacts of fish disease on wild trout populations to fisheries managers and hatchery personnel of the Colorado Division of Wildlife and other resource agencies. Provide specialized information or assistance to the Hatchery Section. Contribute editorial assistance to various professional journals and other organizations upon request.

## TECHNICAL ASSISTANCE MILESTONES

The work described in this Federal Aid Project is closely associated with work conducted by Ron Hedrick, Bernie May, and Melinda Baerwald at the University of California-Davis and Mark Miller of Utah State University to identify markers for WD resistance in select families of fish. The Colorado Division of Wildlife continues to work with these individuals, as well as with other agencies, such as the Utah Department of Natural Resources, the California Department of Fish and Game and the Montana Department of Fish, Wildlife, and Parks, to enhance and accelerate research on rainbow trout strains.

Major contributions in the area of technical assistance included various public and professional meeting presentations, including the following:

1) National American Fisheries Society meeting on September 12, 2006 in Lake Placid, New York.
2) Colorado Wildlife Commission Meeting in Steamboat Springs, Colorado, on August 10, 2006.
3) Continuing Education Biology Teachers group at Parvin Lake Research Station on July 10, 2006.
4) United States Geological Survey meeting in Fort Collins, Colorado on November 2, 2006.
5) 13$^{th}$ Annual Whirling Disease Symposium: Resistance on Two Fronts! Denver, Colorado**,** February 12-13, 2006**.**
6) Colorado-Wyoming annual American Fisheries Society meeting, February 26-March 1, 2007, in Fort Collins, Colorado.

This Federal Aid project has generated considerable public interest. Interviews and materials for popular articles were provided for several periodicals including Colorado Hunting and Fishing News, The Denver Post, The Scientist, Fly Rod and Reel, High Country Angler, and Southwest Fly Fishing. In addition, one professional journal article was published in 2006; "Schisler, G. J., K. A. Myklebust, and R. P. Hedrick. 2006. Inheritance of *Myxobolus cerebralis* resistance among F1-generation crosses of whirling disease resistant and susceptible rainbow trout strains. Journal of Aquatic Animal Health 18:109-115." (See Federal Aid Project Report F-393-R4).

Another technical assistance project that has generated interest among other State and Federal agencies is a small-scale experiment designed to evaluate the efficacy of quaternary ammonia compounds for the disinfection of equipment to prevent the distribution of New Zealand mud snails (*Potamopyrgus antipodarum*). A summary of this work; "Schisler, G. J., N. Vieira, and P. G. Walker. In Press. Application of household disinfectants to eliminate New Zealand mud snails from angling gear", has been submitted and accepted for publication in the North American Journal of Fisheries Management as a management brief. The recommendations for disinfection found in this publication have already been adopted by several agencies, including the United States Forest Service.

## APPENDIX I.

## C-SAP Creel Survey Results for Flatiron and Pinewood Reservoirs

## June 26, 2007 Release

FISHERMAN-HOURS Water 54851 Year 2006 Stat Method N/A

| | Estimate | | | | Std Error | | | |
|---|---|---|---|---|---|---|---|---|
| STRATA | BANK | BOAT | OTHER | ALL | BANK | BOAT | OTHER | ALL |
| MARWD | 413.2 | 0.0 | 0.0 | 413.2 | 102.9 | 0.0 | 0.0 | 102.9 |
| MARWE | 195.2 | 0.0 | 0.0 | 195.2 | 55.0 | 0.0 | 0.0 | 55.0 |
| APRWE | 780.7 | 0.0 | 0.0 | 780.7 | 99.7 | 0.0 | 0.0 | 99.7 |
| APRWD | 877.8 | 5.7 | 0.0 | 883.5 | 205.2 | 3.3 | 0.0 | 204.9 |
| MAYWD | 2027.8 | 84.3 | 25.9 | 2138.0 | 202.5 | 22.3 | 10.8 | 200.8 |
| MAYWE | 2314.9 | 10.4 | 0.0 | 2325.3 | 0.0 | 0.0 | 0.0 | 0.0 |
| JUNWD | 2313.4 | 13.7 | 0.0 | 2327.1 | 238.7 | 8.1 | 0.0 | 239.1 |
| JUNWE | 2539.6 | 0.0 | 0.0 | 2539.6 | 0.0 | 0.0 | 0.0 | 0.0 |
| JULWE | 2240.0 | 0.0 | 0.0 | 2240.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| JULWD | 2408.0 | 0.0 | 0.0 | 2408.0 | 306.8 | 0.0 | 0.0 | 306.8 |
| AUGWD | 1939.2 | 0.0 | 0.0 | 1939.2 | 177.9 | 0.0 | 0.0 | 177.9 |
| AUGWE | 1248.8 | 0.0 | 0.0 | 1248.8 | 0.0 | 0.0 | 0.0 | 0.0 |
| ALL | 19298.6 | 114.1 | 25.9 | 19438.5 | 531.6 | 22.2 | 9.9 | 530.8 |

TOTAL CATCH Water 54851 Year 2006 Stat Method 1

| | Estimate | | | | Std Error | | | |
|---|---|---|---|---|---|---|---|---|
| STRATA | BANK | BOAT | OTHER | ALL | BANK | BOAT | OTHER | ALL |
| MARWD | 45.1 | 0.0 | 0.0 | 45.1 | 22.7 | 0.0 | 0.0 | 22.7 |
| MARWE | 11.6 | 0.0 | 0.0 | 11.6 | 5.8 | 0.0 | 0.0 | 5.8 |
| APRWE | 343.0 | 0.0 | 0.0 | 343.0 | 51.0 | 0.0 | 0.0 | 51.0 |
| APRWD | 738.2 | 0.0 | 0.0 | 738.2 | 214.8 | 0.0 | 0.0 | 214.8 |
| MAYWD | 2798.7 | 0.0 | 0.0 | 2798.7 | 208.9 | 0.0 | 0.0 | 208.9 |
| MAYWE | 1164.7 | 0.0 | 0.0 | 1164.7 | 0.0 | 0.0 | 0.0 | 0.0 |
| JUNWD | 1246.5 | 0.0 | 0.0 | 1246.5 | 306.6 | 0.0 | 0.0 | 306.6 |
| JUNWE | 784.7 | 0.0 | 0.0 | 784.7 | 0.0 | 0.0 | 0.0 | 0.0 |
| JULWE | 553.6 | 0.0 | 0.0 | 553.6 | 0.0 | 0.0 | 0.0 | 0.0 |
| JULWD | 460.7 | 0.0 | 0.0 | 460.7 | 105.3 | 0.0 | 0.0 | 105.3 |
| AUGWD | 800.4 | 0.0 | 0.0 | 800.4 | 64.2 | 0.0 | 0.0 | 64.2 |
| AUGWE | 322.2 | 0.0 | 0.0 | 322.2 | 0.0 | 0.0 | 0.0 | 0.0 |
| ALL | 9269.4 | 0.0 | 0.0 | 9269.4 | 429.7 | 0.0 | 0.0 | 429.7 |
| TOTAL CONTACTS: | | BANK = 1215.0 | | BOAT = 0.0 | OTHER =0.0 | | ALL = 1215.0 | |
| TOTAL HOURS: | | BANK = 5939.0 | | BOAT = 0.0 | OTHER =0.0 | | ALL = 5939.0 | |

TOTAL CATCH/HR Water 54851 Year 2006 Stat Method 1

| | Estimate | | | | Std Error | | | |
|---|---|---|---|---|---|---|---|---|
| STRATA | BANK | BOAT | OTHER | ALL | BANK | BOAT | OTHER | ALL |
| MARWD | 0.109 | 0.000 | 0.000 | 0.109 | 0.044 | 0.000 | 0.000 | 0.044 |
| MARWE | 0.059 | 0.000 | 0.000 | 0.059 | 0.015 | 0.000 | 0.000 | 0.015 |
| APRWE | 0.439 | 0.000 | 0.000 | 0.439 | 0.048 | 0.000 | 0.000 | 0.048 |
| APRWD | 0.841 | 0.000 | 0.000 | 0.836 | 0.109 | 0.000 | 0.000 | 0.109 |
| MAYWD | 1.380 | 0.000 | 0.000 | 1.309 | 0.184 | 0.000 | 0.000 | 0.170 |
| MAYWE | 0.503 | 0.000 | 0.000 | 0.501 | 0.000 | 0.000 | 0.000 | 0.000 |
| JUNWD | 0.539 | 0.000 | 0.000 | 0.536 | 0.087 | 0.000 | 0.000 | 0.087 |
| JUNWE | 0.309 | 0.000 | 0.000 | 0.309 | 0.000 | 0.000 | 0.000 | 0.000 |
| JULWE | 0.247 | 0.000 | 0.000 | 0.247 | 0.000 | 0.000 | 0.000 | 0.000 |
| JULWD | 0.191 | 0.000 | 0.000 | 0.191 | 0.020 | 0.000 | 0.000 | 0.020 |
| AUGWD | 0.413 | 0.000 | 0.000 | 0.413 | 0.033 | 0.000 | 0.000 | 0.033 |
| AUGWE | 0.258 | 0.000 | 0.000 | 0.258 | 0.000 | 0.000 | 0.000 | 0.000 |
| ALL | 0.480 | 0.000 | 0.000 | 0.477 | 0.000 | 0.000 | 0.000 | 0.000 |

CREEL CATCH Water 54851 Year 2006 Stat Method 1

| | Estimate | | | | Std Error | | | |
|---|---|---|---|---|---|---|---|---|
| STRATA | BANK | BOAT | OTHER | ALL | BANK | BOAT | OTHER | ALL |
| MARWD | 30.0 | 0.0 | 0.0 | 30.0 | 15.9 | 0.0 | 0.0 | 15.9 |
| MARWE | 7.7 | 0.0 | 0.0 | 7.7 | 3.9 | 0.0 | 0.0 | 3.9 |
| APRWE | 104.9 | 0.0 | 0.0 | 104.9 | 15.2 | 0.0 | 0.0 | 15.2 |
| APRWD | 413.2 | 0.0 | 0.0 | 413.2 | 99.0 | 0.0 | 0.0 | 99.0 |
| MAYWD | 2322.7 | 0.0 | 0.0 | 2322.7 | 196.7 | 0.0 | 0.0 | 196.7 |
| MAYWE | 1086.8 | 0.0 | 0.0 | 1086.8 | 0.0 | 0.0 | 0.0 | 0.0 |
| JUNWD | 1168.3 | 0.0 | 0.0 | 1168.3 | 271.0 | 0.0 | 0.0 | 271.0 |
| JUNWE | 733.1 | 0.0 | 0.0 | 733.1 | 0.0 | 0.0 | 0.0 | 0.0 |
| JULWE | 537.6 | 0.0 | 0.0 | 537.6 | 0.0 | 0.0 | 0.0 | 0.0 |
| JULWD | 460.7 | 0.0 | 0.0 | 460.7 | 105.3 | 0.0 | 0.0 | 105.3 |
| AUGWD | 754.5 | 0.0 | 0.0 | 754.5 | 68.1 | 0.0 | 0.0 | 68.1 |
| AUGWE | 312.2 | 0.0 | 0.0 | 312.2 | 0.0 | 0.0 | 0.0 | 0.0 |
| ALL | 7931.7 | 0.0 | 0.0 | 7931.7 | 368.8 | 0.0 | 0.0 | 368.8 |

CREEL CATCH/HR Water 54851 Year 2006 Stat Method 1

| | Estimate | | | | Std Error | | | |
|---|---|---|---|---|---|---|---|---|
| STRATA | BANK | BOAT | OTHER | ALL | BANK | BOAT | OTHER | ALL |
| MARWD | 0.073 | 0.000 | 0.000 | 0.073 | 0.032 | 0.000 | 0.000 | 0.032 |
| MARWE | 0.040 | 0.000 | 0.000 | 0.040 | 0.010 | 0.000 | 0.000 | 0.010 |
| APRWE | 0.134 | 0.000 | 0.000 | 0.134 | 0.011 | 0.000 | 0.000 | 0.011 |
| APRWD | 0.471 | 0.000 | 0.000 | 0.468 | 0.091 | 0.000 | 0.000 | 0.091 |
| MAYWD | 1.145 | 0.000 | 0.000 | 1.086 | 0.151 | 0.000 | 0.000 | 0.140 |
| MAYWE | 0.469 | 0.000 | 0.000 | 0.467 | 0.000 | 0.000 | 0.000 | 0.000 |
| JUNWD | 0.505 | 0.000 | 0.000 | 0.502 | 0.074 | 0.000 | 0.000 | 0.074 |
| JUNWE | 0.289 | 0.000 | 0.000 | 0.289 | 0.000 | 0.000 | 0.000 | 0.000 |
| JULWE | 0.240 | 0.000 | 0.000 | 0.240 | 0.000 | 0.000 | 0.000 | 0.000 |
| JULWD | 0.191 | 0.000 | 0.000 | 0.191 | 0.020 | 0.000 | 0.000 | 0.020 |
| AUGWD | 0.389 | 0.000 | 0.000 | 0.389 | 0.032 | 0.000 | 0.000 | 0.032 |
| AUGWE | 0.250 | 0.000 | 0.000 | 0.250 | 0.000 | 0.000 | 0.000 | 0.000 |
| ALL | 0.411 | 0.000 | 0.000 | 0.408 | 0.000 | 0.000 | 0.000 | 0.000 |

RETURNED CATCH Water 54851 Year 2006 Stat Method 1

| | Estimate | | | | Std Error | | | |
|---|---|---|---|---|---|---|---|---|
| STRATA | BANK | BOAT | OTHER | ALL | BANK | BOAT | OTHER | ALL |
| MARWD | 15.2 | 0.0 | 0.0 | 15.2 | 8.0 | 0.0 | 0.0 | 8.0 |
| MARWE | 3.9 | 0.0 | 0.0 | 3.9 | 1.9 | 0.0 | 0.0 | 1.9 |
| APRWE | 238.1 | 0.0 | 0.0 | 238.1 | 41.4 | 0.0 | 0.0 | 41.4 |
| APRWD | 325.1 | 0.0 | 0.0 | 325.1 | 134.7 | 0.0 | 0.0 | 134.7 |
| MAYWD | 476.0 | 0.0 | 0.0 | 476.0 | 61.0 | 0.0 | 0.0 | 61.0 |
| MAYWE | 77.9 | 0.0 | 0.0 | 77.9 | 0.0 | 0.0 | 0.0 | 0.0 |
| JUNWD | 78.2 | 0.0 | 0.0 | 78.2 | 41.2 | 0.0 | 0.0 | 41.2 |
| JUNWE | 51.5 | 0.0 | 0.0 | 51.5 | 0.0 | 0.0 | 0.0 | 0.0 |
| JULWE | 16.1 | 0.0 | 0.0 | 16.1 | 0.0 | 0.0 | 0.0 | 0.0 |
| JULWD | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| AUGWD | 45.9 | 0.0 | 0.0 | 45.9 | 14.9 | 0.0 | 0.0 | 14.9 |
| AUGWE | 10.0 | 0.0 | 0.0 | 10.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| ALL | 1337.7 | 0.0 | 0.0 | 1337.7 | 141.7 | 0.0 | 0.0 | 141.7 |

RETURNED CATCH/HR Water 54851 Year 2006 Stat Method 1

| | Estimate | | | | Std Error | | | |
|---|---|---|---|---|---|---|---|---|
| STRATA | BANK | BOAT | OTHER | ALL | BANK | BOAT | OTHER | ALL |
| MARWD | 0.037 | 0.000 | 0.000 | 0.037 | 0.015 | 0.000 | 0.000 | 0.015 |
| MARWE | 0.020 | 0.000 | 0.000 | 0.020 | 0.000 | 0.000 | 0.000 | 0.000 |
| APRWE | 0.305 | 0.000 | 0.000 | 0.305 | 0.045 | 0.000 | 0.000 | 0.045 |
| APRWD | 0.370 | 0.000 | 0.000 | 0.368 | 0.076 | 0.000 | 0.000 | 0.076 |
| MAYWD | 0.235 | 0.000 | 0.000 | 0.223 | 0.046 | 0.000 | 0.000 | 0.042 |
| MAYWE | 0.034 | 0.000 | 0.000 | 0.033 | 0.000 | 0.000 | 0.000 | 0.000 |
| JUNWD | 0.034 | 0.000 | 0.000 | 0.034 | 0.015 | 0.000 | 0.000 | 0.015 |
| JUNWE | 0.020 | 0.000 | 0.000 | 0.020 | 0.000 | 0.000 | 0.000 | 0.000 |
| JULWE | 0.007 | 0.000 | 0.000 | 0.007 | 0.000 | 0.000 | 0.000 | 0.000 |
| JULWD | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| AUGWD | 0.024 | 0.000 | 0.000 | 0.024 | 0.008 | 0.000 | 0.000 | 0.008 |
| AUGWE | 0.008 | 0.000 | 0.000 | 0.008 | 0.000 | 0.000 | 0.000 | 0.000 |
| ALL | 0.069 | 0.000 | 0.000 | 0.069 | 0.000 | 0.000 | 0.000 | 0.000 |

FISHERMAN Water 54851 Year 2006 Stat Method 1

| | Estimate | | | | Std Error | | | |
|---|---|---|---|---|---|---|---|---|
| STRATA | BANK | BOAT | OTHER | ALL | BANK | BOAT | OTHER | ALL |
| MARWD | 108.8 | 0.0 | 0.0 | 108.8 | 24.7 | 0.0 | 0.0 | 24.7 |
| MARWE | 68.1 | 0.0 | 0.0 | 68.1 | 20.3 | 0.0 | 0.0 | 20.3 |
| APRWE | 115.4 | 0.0 | 0.0 | 115.4 | 9.3 | 0.0 | 0.0 | 9.3 |
| APRWD | 215.1 | 0.0 | 0.0 | 215.1 | 37.8 | 0.0 | 0.0 | 37.8 |
| MAYWD | 853.4 | 0.0 | 0.0 | 853.4 | 123.4 | 0.0 | 0.0 | 123.4 |
| MAYWE | 358.2 | 0.0 | 0.0 | 358.2 | 0.0 | 0.0 | 0.0 | 0.0 |
| JUNWD | 735.0 | 0.0 | 0.0 | 735.0 | 84.4 | 0.0 | 0.0 | 84.4 |
| JUNWE | 594.9 | 0.0 | 0.0 | 594.9 | 0.0 | 0.0 | 0.0 | 0.0 |
| JULWE | 432.4 | 0.0 | 0.0 | 432.4 | 0.0 | 0.0 | 0.0 | 0.0 |
| JULWD | 562.1 | 0.0 | 0.0 | 562.1 | 96.0 | 0.0 | 0.0 | 96.0 |
| AUGWD | 621.9 | 0.0 | 0.0 | 621.9 | 74.9 | 0.0 | 0.0 | 74.9 |
| AUGWE | 245.5 | 0.0 | 0.0 | 245.5 | 0.0 | 0.0 | 0.0 | 0.0 |
| ALL | 4910.7 | 0.0 | 0.0 | 4910.7 | 182.6 | 0.0 | 0.0 | 182.6 |

Average Kept Catch Size (In INCH) Water 54851 Year 2006 Stat Method 1

| | Estimate | | | |
|---|---|---|---|---|
| STRATA | BANK | BOAT | OTHER | ALL |
| MARWD | 10.9 | 0.0 | 0.0 | 10.9 |
| MARWE | 13.0 | 0.0 | 0.0 | 13.0 |
| APRWE | 11.6 | 0.0 | 0.0 | 11.6 |
| APRWD | 10.8 | 0.0 | 0.0 | 10.8 |
| MAYWD | 12.0 | 0.0 | 0.0 | 12.0 |
| MAYWE | 12.0 | 0.0 | 0.0 | 12.0 |
| JUNWD | 12.2 | 0.0 | 0.0 | 12.2 |
| JUNWE | 12.0 | 0.0 | 0.0 | 12.0 |
| JULWE | 12.0 | 0.0 | 0.0 | 12.0 |
| JULWD | 12.4 | 0.0 | 0.0 | 12.4 |
| AUGWD | 11.2 | 0.0 | 0.0 | 11.2 |
| AUGWE | 11.1 | 0.0 | 0.0 | 11.1 |
| ALL | 11.9 | 0.0 | 0.0 | 11.9 |

Average Kept Catch Size (In CM) Water 54851 Year 2006 Stat Method 1

| | Estimate | | | |
|---|---|---|---|---|
| STRATA | BANK | BOAT | OTHER | ALL |
| MARWD | 27.67 | 0 | 0 | 27.67 |
| MARWE | 33.02 | 0 | 0 | 33.02 |
| APRWE | 29.47 | 0 | 0 | 29.47 |
| APRWD | 27.38 | 0 | 0 | 27.38 |
| MAYWD | 30.58 | 0 | 0 | 30.58 |
| MAYWE | 30.58 | 0 | 0 | 30.58 |
| JUNWD | 30.94 | 0 | 0 | 30.94 |
| JUNWE | 30.55 | 0 | 0 | 30.55 |
| JULWE | 30.35 | 0 | 0 | 30.35 |
| JULWD | 31.52 | 0 | 0 | 31.52 |
| AUGWD | 28.52 | 0 | 0 | 28.52 |
| AUGWE | 28.3 | 0 | 0 | 28.3 |
| ALL | 30.23 | 0 | 0 | 30.23 |

Average Completed Trip Length Water 54851 Year 2006 Stat Method

| | Estimate | | | |
|---|---|---|---|---|
| STRATA | BANK | BOAT | OTHER | ALL |
| MARWD | 2.1 | 0.0 | 0.0 | 2.1 |
| MARWE | 1.7 | 0.0 | 0.0 | 1.7 |
| APRWE | 3.0 | 0.0 | 0.0 | 3.0 |
| APRWD | 2.9 | 0.0 | 0.0 | 2.9 |
| MAYWD | 3.1 | 0.0 | 0.0 | 3.1 |
| MAYWE | 2.5 | 0.0 | 0.0 | 2.5 |
| JUNWD | 1.8 | 0.0 | 0.0 | 1.8 |
| JUNWE | 2.4 | 0.0 | 0.0 | 2.4 |
| JULWE | 2.9 | 0.0 | 0.0 | 2.9 |
| JULWD | 2.2 | 0.0 | 0.0 | 2.2 |
| AUGWD | 2.2 | 0.0 | 0.0 | 2.2 |
| AUGWE | 3.2 | 0.0 | 0.0 | 3.2 |
| ALL | 2.6 | 0.0 | 0.0 | 2.6 |

SUMMARY Water 54851 Year 2006 Stat Method 1

| | Estimate | | | | Std Error | | | |
|---|---|---|---|---|---|---|---|---|
| REPORT | BANK | BOAT | OTHER | ALL | BANK | BOAT | OTHER | ALL |
| Fisherman Hours | 19298.6 | 114.1 | 25.9 | 19438.5 | 531.6 | 22.2 | 9.9 | 530.8 |
| Total Catch | 9269.4 | 0.0 | 0.0 | 9269.4 | 429.7 | 0.0 | 0.0 | 429.7 |
| Total Catch/hour | 0.480 | 0.000 | 0.000 | 0.477 | 0.000 | 0.000 | 0.000 | 0.000 |
| Kept catch | 7931.7 | 0.0 | 0.0 | 7931.7 | 368.8 | 0.0 | 0.0 | 368.8 |
| Kept Catch/hour | 0.411 | 0.000 | 0.000 | 0.408 | 0.000 | 0.000 | 0.000 | 0.000 |
| Returned Catch | 1337.7 | 0.0 | 0.0 | 1337.7 | 141.7 | 0.0 | 0.0 | 141.7 |
| Returned Catch/hour | 0.069 | 0.000 | 0.000 | 0.069 | 0.000 | 0.000 | 0.000 | 0.000 |
| Fisherman | 4910.7 | 0.0 | 0.0 | 4910.7 | 182.6 | 0.0 | 0.0 | 182.6 |
| Average Kept Catch Size (INCH) | 11.9 | 0.0 | 0.0 | 11.9 | | | | |
| Average Kept Catch Size (CM) | 30.23 | 0 | 0 | 30.23 | | | | |
| Average Trip Length | 2.6 | 0.0 | 0.0 | 2.6 | | | | |

TOTAL CATCH SPC CUT Water 54851 Year 2006 Stat Method 1

| | Estimate | | | | Std Error | | | |
|---|---|---|---|---|---|---|---|---|
| STRATA | BANK | BOAT | OTHER | ALL | BANK | BOAT | OTHER | ALL |
| MARWD | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| MARWE | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| APRWE | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| APRWD | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| MAYWD | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| MAYWE | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| JUNWD | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| JUNWE | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| JULWE | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| JULWD | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| AUGWD | 371.3 | 0.0 | 0.0 | 371.3 | 66.0 | 0.0 | 0.0 | 66.0 |
| AUGWE | 113.9 | 0.0 | 0.0 | 113.9 | 0.0 | 0.0 | 0.0 | 0.0 |
| ALL | 485.2 | 0.0 | 0.0 | 485.2 | 54.0 | 0.0 | 0.0 | 54.0 |
| TOTAL CONTACTS: | BANK = 1215.0 | BOAT = 0.0 | | | OTHER =0.0 | ALL = 1215.0 | | |
| TOTAL HOURS: | BANK = 5939.0 | BOAT = 0.0 | | | OTHER =0.0 | ALL = 5939.0 | | |

TOTAL CATCH/HR SPC CUT Water 54851 Year 2006 Stat Method 1

| | Estimate | | | | Std Error | | | |
|---|---|---|---|---|---|---|---|---|
| STRATA | BANK | BOAT | OTHER | ALL | BANK | BOAT | OTHER | ALL |
| MARWD | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| MARWE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| APRWE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| APRWD | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| MAYWD | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| MAYWE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| JUNWD | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| JUNWE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| JULWE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| JULWD | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| AUGWD | 0.191 | 0.000 | 0.000 | 0.191 | 0.034 | 0.000 | 0.000 | 0.034 |
| AUGWE | 0.091 | 0.000 | 0.000 | 0.091 | 0.000 | 0.000 | 0.000 | 0.000 |
| ALL | 0.025 | 0.000 | 0.000 | 0.025 | 0.000 | 0.000 | 0.000 | 0.000 |

CREEL CATCH SPC CUT Water 54851 Year 2006 Stat Method 1

| | Estimate | | | | Std Error | | | |
|---|---|---|---|---|---|---|---|---|
| STRATA | BANK | BOAT | OTHER | ALL | BANK | BOAT | OTHER | ALL |
| MARWD | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| MARWE | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| APRWE | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| APRWD | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| MAYWD | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| MAYWE | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| JUNWD | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| JUNWE | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| JULWE | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| JULWD | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| AUGWD | 353.6 | 0.0 | 0.0 | 353.6 | 64.5 | 0.0 | 0.0 | 64.5 |
| AUGWE | 112.4 | 0.0 | 0.0 | 112.4 | 0.0 | 0.0 | 0.0 | 0.0 |
| ALL | 465.9 | 0.0 | 0.0 | 465.9 | 52.8 | 0.0 | 0.0 | 52.8 |

CREEL CATCH/HR SPC CUT Water 54851 Year 2006 Stat Method 1

| | Estimate | | | | Std Error | | | |
|---|---|---|---|---|---|---|---|---|
| STRATA | BANK | BOAT | OTHER | ALL | BANK | BOAT | OTHER | ALL |
| MARWD | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| MARWE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| APRWE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| APRWD | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| MAYWD | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| MAYWE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| JUNWD | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| JUNWE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| JULWE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| JULWD | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| AUGWD | 0.182 | 0.000 | 0.000 | 0.182 | 0.033 | 0.000 | 0.000 | 0.033 |
| AUGWE | 0.090 | 0.000 | 0.000 | 0.090 | 0.000 | 0.000 | 0.000 | 0.000 |
| ALL | 0.024 | 0.000 | 0.000 | 0.024 | 0.000 | 0.000 | 0.000 | 0.000 |

RETURNED CATCH SPC CUT Water 54851 Year 2006 Stat Method 1

| | Estimate | | | | Std Error | | | |
|---|---|---|---|---|---|---|---|---|
| STRATA | BANK | BOAT | OTHER | ALL | BANK | BOAT | OTHER | ALL |
| MARWD | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| MARWE | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| APRWE | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| APRWD | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| MAYWD | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| MAYWE | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| JUNWD | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| JUNWE | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| JULWE | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| JULWD | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| AUGWD | 17.7 | 0.0 | 0.0 | 17.7 | 7.5 | 0.0 | 0.0 | 7.5 |
| AUGWE | 1.6 | 0.0 | 0.0 | 1.6 | 0.0 | 0.0 | 0.0 | 0.0 |
| ALL | 19.3 | 0.0 | 0.0 | 19.3 | 5.9 | 0.0 | 0.0 | 5.9 |

RETURNED CATCH/HR SPC CUT Water 54851 Year 2006 Stat Method 1

| | Estimate | | | | Std Error | | | |
|---|---|---|---|---|---|---|---|---|
| STRATA | BANK | BOAT | OTHER | ALL | BANK | BOAT | OTHER | ALL |
| MARWD | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| MARWE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| APRWE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| APRWD | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| MAYWD | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| MAYWE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| JUNWD | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| JUNWE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| JULWE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| JULWD | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| AUGWD | 0.009 | 0.000 | 0.000 | 0.009 | 0.000 | 0.000 | 0.000 | 0.000 |
| AUGWE | 0.001 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 |
| ALL | 0.001 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 |

Average Kept Catch Size (In INCH) SPC CUT Water 54851 Year 2006 Stat Method 1

| | | Estimate | | | |
|---|---|---|---|---|---|
| STRATA | BANK | BOAT | OTHER | ALL | |
| MARWD | 0.0 | 0.0 | 0.0 | 0.0 | |
| MARWE | 0.0 | 0.0 | 0.0 | 0.0 | |
| APRWE | 0.0 | 0.0 | 0.0 | 0.0 | |
| APRWD | 0.0 | 0.0 | 0.0 | 0.0 | |
| MAYWD | 0.0 | 0.0 | 0.0 | 0.0 | |
| MAYWE | 0.0 | 0.0 | 0.0 | 0.0 | |
| JUNWD | 0.0 | 0.0 | 0.0 | 0.0 | |
| JUNWE | 0.0 | 0.0 | 0.0 | 0.0 | |
| JULWE | 0.0 | 0.0 | 0.0 | 0.0 | |
| JULWD | 0.0 | 0.0 | 0.0 | 0.0 | |
| AUGWD | 11.1 | 0.0 | 0.0 | 11.1 | |
| AUGWE | 11.3 | 0.0 | 0.0 | 11.3 | |
| ALL | 11.1 | 0.0 | 0.0 | 11.1 | |

Average Kept Catch Size (In CM) SPC CUT Water 54851 Year 2006 Stat Method 1

| | | Estimate | | | |
|---|---|---|---|---|---|
| STRATA | BANK | BOAT | OTHER | ALL | |
| MARWD | 0 | 0 | 0 | 0 | |
| MARWE | 0 | 0 | 0 | 0 | |
| APRWE | 0 | 0 | 0 | 0 | |
| APRWD | 0 | 0 | 0 | 0 | |
| MAYWD | 0 | 0 | 0 | 0 | |
| MAYWE | 0 | 0 | 0 | 0 | |
| JUNWD | 0 | 0 | 0 | 0 | |
| JUNWE | 0 | 0 | 0 | 0 | |
| JULWE | 0 | 0 | 0 | 0 | |
| JULWD | 0 | 0 | 0 | 0 | |
| AUGWD | 28.11 | 0 | 0 | 28.11 | |
| AUGWE | 28.6 | 0 | 0 | 28.6 | |
| ALL | 28.19 | 0 | 0 | 28.19 | |

Average Completed Trip Length Water 54851 Year 2006 Stat Method

| | | Estimate | | | |
|---|---|---|---|---|---|
| STRATA | BANK | BOAT | OTHER | ALL | |
| MARWD | 2.1 | 0.0 | 0.0 | 2.1 | |
| MARWE | 1.7 | 0.0 | 0.0 | 1.7 | |
| APRWE | 3.0 | 0.0 | 0.0 | 3.0 | |
| APRWD | 2.9 | 0.0 | 0.0 | 2.9 | |
| MAYWD | 3.1 | 0.0 | 0.0 | 3.1 | |
| MAYWE | 2.5 | 0.0 | 0.0 | 2.5 | |
| JUNWD | 1.8 | 0.0 | 0.0 | 1.8 | |
| JUNWE | 2.4 | 0.0 | 0.0 | 2.4 | |
| JULWE | 2.9 | 0.0 | 0.0 | 2.9 | |
| JULWD | 2.2 | 0.0 | 0.0 | 2.2 | |
| AUGWD | 2.2 | 0.0 | 0.0 | 2.2 | |
| AUGWE | 3.2 | 0.0 | 0.0 | 3.2 | |
| ALL | 2.6 | 0.0 | 0.0 | 2.6 | |

SUMMARY SPC CUT Water 54851 Year 2006 Stat Method 1

| | Estimate | | | | Std Error | | | |
|---|---|---|---|---|---|---|---|---|
| REPORT | BANK | BOAT | OTHER | ALL | BANK | BOAT | OTHER | ALL |
| Total Catch | 485.2 | 0.0 | 0.0 | 485.2 | 54.0 | 0.0 | 0.0 | 54.0 |
| Total Catch/hour | 0.025 | 0.000 | 0.000 | 0.025 | 0.000 | 0.000 | 0.000 | 0.000 |
| Kept catch | 465.9 | 0.0 | 0.0 | 465.9 | 52.8 | 0.0 | 0.0 | 52.8 |
| Kept Catch/hour | 0.024 | 0.000 | 0.000 | 0.024 | 0.000 | 0.000 | 0.000 | 0.000 |
| Returned Catch | 19.3 | 0.0 | 0.0 | 19.3 | 5.9 | 0.0 | 0.0 | 5.9 |
| Returned Catch/hour | 0.001 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 |
| Average Kept Catch Size (INCH) | 11.1 | 0.0 | 0.0 | 11.1 | | | | |
| Average Kept Catch Size (CM) | 28.22 | 0 | 0 | 28.22 | | | | |
| Average Trip Length | 2.6 | 0.0 | 0.0 | 2.6 | | | | |

TOTAL CATCH SPC KOK Water 54851 Year 2006 Stat Method 1

| | Estimate | | | | Std Error | | | |
|---|---|---|---|---|---|---|---|---|
| STRATA | BANK | BOAT | OTHER | ALL | BANK | BOAT | OTHER | ALL |
| MARWD | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| MARWE | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| APRWE | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| APRWD | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| MAYWD | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| MAYWE | 1.7 | 0.0 | 0.0 | 1.7 | 0.0 | 0.0 | 0.0 | 0.0 |
| JUNWD | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| JUNWE | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| JULWE | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| JULWD | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| AUGWD | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| AUGWE | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| ALL | 1.7 | 0.0 | 0.0 | 1.7 | 0.8 | 0.0 | 0.0 | 0.8 |
| TOTAL CONTACTS: | | BANK = 1215.0 | | BOAT = 0.0 | OTHER =0.0 | | ALL = 1215.0 | |
| TOTAL HOURS: | | BANK = 5939.0 | | BOAT = 0.0 | OTHER =0.0 | | ALL = 5939.0 | |

TOTAL CATCH/HR SPC KOK Water 54851 Year 2006 Stat Method 1

| | Estimate | | | | Std Error | | | |
|---|---|---|---|---|---|---|---|---|
| STRATA | BANK | BOAT | OTHER | ALL | BANK | BOAT | OTHER | ALL |
| MARWD | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| MARWE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| APRWE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| APRWD | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| MAYWD | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| MAYWE | 0.001 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 |
| JUNWD | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| JUNWE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| JULWE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| JULWD | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| AUGWD | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| AUGWE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| ALL | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |

CREEL CATCH SPC KOK Water 54851 Year 2006 Stat Method 1

| | Estimate | | | | Std Error | | | |
|---|---|---|---|---|---|---|---|---|
| STRATA | BANK | BOAT | OTHER | ALL | BANK | BOAT | OTHER | ALL |
| MARWD | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| MARWE | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| APRWE | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| APRWD | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| MAYWD | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| MAYWE | 1.7 | 0.0 | 0.0 | 1.7 | 0.0 | 0.0 | 0.0 | 0.0 |
| JUNWD | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| JUNWE | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| JULWE | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| JULWD | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| AUGWD | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| AUGWE | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| ALL | 1.7 | 0.0 | 0.0 | 1.7 | 0.8 | 0.0 | 0.0 | 0.8 |

CREEL CATCH/HR SPC KOK Water 54851 Year 2006 Stat Method 1

| | Estimate | | | | Std Error | | | |
|---|---|---|---|---|---|---|---|---|
| STRATA | BANK | BOAT | OTHER | ALL | BANK | BOAT | OTHER | ALL |
| MARWD | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| MARWE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| APRWE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| APRWD | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| MAYWD | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| MAYWE | 0.001 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 |
| JUNWD | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| JUNWE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| JULWE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| JULWD | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| AUGWD | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| AUGWE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| ALL | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |

RETURNED CATCH SPC KOK Water 54851 Year 2006 Stat Method 1

| | Estimate | | | | Std Error | | | |
|---|---|---|---|---|---|---|---|---|
| STRATA | BANK | BOAT | OTHER | ALL | BANK | BOAT | OTHER | ALL |
| MARWD | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| MARWE | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| APRWE | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| APRWD | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| MAYWD | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| MAYWE | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| JUNWD | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| JUNWE | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| JULWE | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| JULWD | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| AUGWD | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| AUGWE | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| ALL | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |

RETURNED CATCH/HR SPC KOK Water 54851 Year 2006 Stat Method 1

| | Estimate | | | | Std Error | | | |
|---|---|---|---|---|---|---|---|---|
| STRATA | BANK | BOAT | OTHER | ALL | BANK | BOAT | OTHER | ALL |
| MARWD | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| MARWE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| APRWE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| APRWD | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| MAYWD | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| MAYWE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| JUNWD | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| JUNWE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| JULWE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| JULWD | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| AUGWD | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| AUGWE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| ALL | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |

Average Kept Catch Size (In INCH) SPC KOK Water 54851 Year 2006 Stat Method 1

| | Estimate | | | |
|---|---|---|---|---|
| STRATA | BANK | BOAT | OTHER | ALL |
| MARWD | 0.0 | 0.0 | 0.0 | 0.0 |
| MARWE | 0.0 | 0.0 | 0.0 | 0.0 |
| APRWE | 0.0 | 0.0 | 0.0 | 0.0 |
| APRWD | 0.0 | 0.0 | 0.0 | 0.0 |
| MAYWD | 0.0 | 0.0 | 0.0 | 0.0 |
| MAYWE | 12.5 | 0.0 | 0.0 | 12.5 |
| JUNWD | 0.0 | 0.0 | 0.0 | 0.0 |
| JUNWE | 0.0 | 0.0 | 0.0 | 0.0 |
| JULWE | 0.0 | 0.0 | 0.0 | 0.0 |
| JULWD | 0.0 | 0.0 | 0.0 | 0.0 |
| AUGWD | 0.0 | 0.0 | 0.0 | 0.0 |
| AUGWE | 0.0 | 0.0 | 0.0 | 0.0 |
| ALL | 12.5 | 0.0 | 0.0 | 12.5 |

Average Kept Catch Size (In CM) SPC KOK Water 54851 Year 2006 Stat Method 1

| | Estimate | | | |
|---|---|---|---|---|
| STRATA | BANK | BOAT | OTHER | ALL |
| MARWD | 0 | 0 | 0 | 0 |
| MARWE | 0 | 0 | 0 | 0 |
| APRWE | 0 | 0 | 0 | 0 |
| APRWD | 0 | 0 | 0 | 0 |
| MAYWD | 0 | 0 | 0 | 0 |
| MAYWE | 31.75 | 0 | 0 | 31.75 |
| JUNWD | 0 | 0 | 0 | 0 |
| JUNWE | 0 | 0 | 0 | 0 |
| JULWE | 0 | 0 | 0 | 0 |
| JULWD | 0 | 0 | 0 | 0 |
| AUGWD | 0 | 0 | 0 | 0 |
| AUGWE | 0 | 0 | 0 | 0 |
| ALL | 31.75 | 0 | 0 | 31.75 |

Average Completed Trip Length Water 54851 Year 2006 Stat Method

| | Estimate | | | | |
|---|---|---|---|---|---|
| STRATA | BANK | BOAT | OTHER | ALL | |
| MARWD | 2.1 | 0.0 | 0.0 | 2.1 | |
| MARWE | 1.7 | 0.0 | 0.0 | 1.7 | |
| APRWE | 3.0 | 0.0 | 0.0 | 3.0 | |
| APRWD | 2.9 | 0.0 | 0.0 | 2.9 | |
| MAYWD | 3.1 | 0.0 | 0.0 | 3.1 | |
| MAYWE | 2.5 | 0.0 | 0.0 | 2.5 | |
| JUNWD | 1.8 | 0.0 | 0.0 | 1.8 | |
| JUNWE | 2.4 | 0.0 | 0.0 | 2.4 | |
| JULWE | 2.9 | 0.0 | 0.0 | 2.9 | |
| JULWD | 2.2 | 0.0 | 0.0 | 2.2 | |
| AUGWD | 2.2 | 0.0 | 0.0 | 2.2 | |
| AUGWE | 3.2 | 0.0 | 0.0 | 3.2 | |
| ALL | 2.6 | 0.0 | 0.0 | 2.6 | |

SUMMARY SPC KOK Water 54851 Year 2006 Stat Method 1

| | Estimate | | | | Std Error | | | |
|---|---|---|---|---|---|---|---|---|
| REPORT | BANK | BOAT | OTHER | ALL | BANK | BOAT | OTHER | ALL |
| Total Catch | 1.7 | 0.0 | 0.0 | 1.7 | 0.8 | 0.0 | 0.0 | 0.8 |
| Total Catch/hour | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Kept catch | 1.7 | 0.0 | 0.0 | 1.7 | 0.8 | 0.0 | 0.0 | 0.8 |
| Kept Catch/hour | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Returned Catch | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Returned Catch/hour | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Average Kept Catch Size (INCH) | 12.5 | 0.0 | 0.0 | 12.5 | | | | |
| Average Kept Catch Size (CM) | 31.75 | 0 | 0 | 31.75 | | | | |
| Average Trip Length | 2.6 | 0.0 | 0.0 | 2.6 | | | | |

TOTAL CATCH SPC RBT Water 54851 Year 2006 Stat Method 1

| | Estimate | | | | Std Error | | | |
|---|---|---|---|---|---|---|---|---|
| STRATA | BANK | BOAT | OTHER | ALL | BANK | BOAT | OTHER | ALL |
| MARWD | 23.7 | 0.0 | 0.0 | 23.7 | 8.6 | 0.0 | 0.0 | 8.6 |
| MARWE | 11.6 | 0.0 | 0.0 | 11.6 | 5.8 | 0.0 | 0.0 | 5.8 |
| APRWE | 343.0 | 0.0 | 0.0 | 343.0 | 51.0 | 0.0 | 0.0 | 51.0 |
| APRWD | 738.2 | 0.0 | 0.0 | 738.2 | 214.8 | 0.0 | 0.0 | 214.8 |
| MAYWD | 2798.7 | 0.0 | 0.0 | 2798.7 | 208.9 | 0.0 | 0.0 | 208.9 |
| MAYWE | 1163.0 | 0.0 | 0.0 | 1163.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| JUNWD | 1246.5 | 0.0 | 0.0 | 1246.5 | 306.6 | 0.0 | 0.0 | 306.6 |
| JUNWE | 784.7 | 0.0 | 0.0 | 784.7 | 0.0 | 0.0 | 0.0 | 0.0 |
| JULWE | 553.6 | 0.0 | 0.0 | 553.6 | 0.0 | 0.0 | 0.0 | 0.0 |
| JULWD | 460.7 | 0.0 | 0.0 | 460.7 | 105.3 | 0.0 | 0.0 | 105.3 |
| AUGWD | 429.0 | 0.0 | 0.0 | 429.0 | 72.3 | 0.0 | 0.0 | 72.3 |
| AUGWE | 208.2 | 0.0 | 0.0 | 208.2 | 0.0 | 0.0 | 0.0 | 0.0 |
| ALL | 8761.0 | 0.0 | 0.0 | 8761.0 | 430.3 | 0.0 | 0.0 | 430.3 |
| TOTAL CONTACTS: | BANK = 1215.0 | | BOAT = 0.0 | | OTHER =0.0 | | ALL = 1215.0 | |
| TOTAL HOURS: | BANK = 5939.0 | | BOAT = 0.0 | | OTHER =0.0 | | ALL = 5939.0 | |

TOTAL CATCH/HR SPC RBT Water 54851 Year 2006 Stat Method 1

| | Estimate | | | | Std Error | | | |
|---|---|---|---|---|---|---|---|---|
| STRATA | BANK | BOAT | OTHER | ALL | BANK | BOAT | OTHER | ALL |
| MARWD | 0.057 | 0.000 | 0.000 | 0.057 | 0.011 | 0.000 | 0.000 | 0.011 |
| MARWE | 0.059 | 0.000 | 0.000 | 0.059 | 0.015 | 0.000 | 0.000 | 0.015 |
| APRWE | 0.439 | 0.000 | 0.000 | 0.439 | 0.048 | 0.000 | 0.000 | 0.048 |
| APRWD | 0.841 | 0.000 | 0.000 | 0.836 | 0.109 | 0.000 | 0.000 | 0.109 |
| MAYWD | 1.380 | 0.000 | 0.000 | 1.309 | 0.184 | 0.000 | 0.000 | 0.170 |
| MAYWE | 0.502 | 0.000 | 0.000 | 0.500 | 0.000 | 0.000 | 0.000 | 0.000 |
| JUNWD | 0.539 | 0.000 | 0.000 | 0.536 | 0.087 | 0.000 | 0.000 | 0.087 |
| JUNWE | 0.309 | 0.000 | 0.000 | 0.309 | 0.000 | 0.000 | 0.000 | 0.000 |
| JULWE | 0.247 | 0.000 | 0.000 | 0.247 | 0.000 | 0.000 | 0.000 | 0.000 |
| JULWD | 0.191 | 0.000 | 0.000 | 0.191 | 0.020 | 0.000 | 0.000 | 0.020 |
| AUGWD | 0.221 | 0.000 | 0.000 | 0.221 | 0.037 | 0.000 | 0.000 | 0.037 |
| AUGWE | 0.167 | 0.000 | 0.000 | 0.167 | 0.000 | 0.000 | 0.000 | 0.000 |
| ALL | 0.454 | 0.000 | 0.000 | 0.451 | 0.000 | 0.000 | 0.000 | 0.000 |

CREEL CATCH SPC RBT Water 54851 Year 2006 Stat Method 1

| | Estimate | | | | Std Error | | | |
|---|---|---|---|---|---|---|---|---|
| STRATA | BANK | BOAT | OTHER | ALL | BANK | BOAT | OTHER | ALL |
| MARWD | 19.2 | 0.0 | 0.0 | 19.2 | 9.1 | 0.0 | 0.0 | 9.1 |
| MARWE | 7.7 | 0.0 | 0.0 | 7.7 | 3.9 | 0.0 | 0.0 | 3.9 |
| APRWE | 104.9 | 0.0 | 0.0 | 104.9 | 15.2 | 0.0 | 0.0 | 15.2 |
| APRWD | 413.2 | 0.0 | 0.0 | 413.2 | 99.0 | 0.0 | 0.0 | 99.0 |
| MAYWD | 2322.7 | 0.0 | 0.0 | 2322.7 | 196.7 | 0.0 | 0.0 | 196.7 |
| MAYWE | 1085.2 | 0.0 | 0.0 | 1085.2 | 0.0 | 0.0 | 0.0 | 0.0 |
| JUNWD | 1168.3 | 0.0 | 0.0 | 1168.3 | 271.0 | 0.0 | 0.0 | 271.0 |
| JUNWE | 733.1 | 0.0 | 0.0 | 733.1 | 0.0 | 0.0 | 0.0 | 0.0 |
| JULWE | 537.6 | 0.0 | 0.0 | 537.6 | 0.0 | 0.0 | 0.0 | 0.0 |
| JULWD | 460.7 | 0.0 | 0.0 | 460.7 | 105.3 | 0.0 | 0.0 | 105.3 |
| AUGWD | 400.9 | 0.0 | 0.0 | 400.9 | 68.3 | 0.0 | 0.0 | 68.3 |
| AUGWE | 199.8 | 0.0 | 0.0 | 199.8 | 0.0 | 0.0 | 0.0 | 0.0 |
| ALL | 7453.3 | 0.0 | 0.0 | 7453.3 | 368.7 | 0.0 | 0.0 | 368.7 |

CREEL CATCH/HR SPC RBT Water 54851 Year 2006 Stat Method 1

| | Estimate | | | | Std Error | | | |
|---|---|---|---|---|---|---|---|---|
| STRATA | BANK | BOAT | OTHER | ALL | BANK | BOAT | OTHER | ALL |
| MARWD | 0.047 | 0.000 | 0.000 | 0.047 | 0.017 | 0.000 | 0.000 | 0.017 |
| MARWE | 0.040 | 0.000 | 0.000 | 0.040 | 0.010 | 0.000 | 0.000 | 0.010 |
| APRWE | 0.134 | 0.000 | 0.000 | 0.134 | 0.011 | 0.000 | 0.000 | 0.011 |
| APRWD | 0.471 | 0.000 | 0.000 | 0.468 | 0.091 | 0.000 | 0.000 | 0.091 |
| MAYWD | 1.145 | 0.000 | 0.000 | 1.086 | 0.151 | 0.000 | 0.000 | 0.140 |
| MAYWE | 0.469 | 0.000 | 0.000 | 0.467 | 0.000 | 0.000 | 0.000 | 0.000 |
| JUNWD | 0.505 | 0.000 | 0.000 | 0.502 | 0.074 | 0.000 | 0.000 | 0.074 |
| JUNWE | 0.289 | 0.000 | 0.000 | 0.289 | 0.000 | 0.000 | 0.000 | 0.000 |
| JULWE | 0.240 | 0.000 | 0.000 | 0.240 | 0.000 | 0.000 | 0.000 | 0.000 |
| JULWD | 0.191 | 0.000 | 0.000 | 0.191 | 0.020 | 0.000 | 0.000 | 0.020 |
| AUGWD | 0.207 | 0.000 | 0.000 | 0.207 | 0.034 | 0.000 | 0.000 | 0.034 |
| AUGWE | 0.160 | 0.000 | 0.000 | 0.160 | 0.000 | 0.000 | 0.000 | 0.000 |
| ALL | 0.386 | 0.000 | 0.000 | 0.383 | 0.000 | 0.000 | 0.000 | 0.000 |

RETURNED CATCH SPC RBT Water 54851 Year 2006 Stat Method 1

| | Estimate | | | | Std Error | | | |
|---|---|---|---|---|---|---|---|---|
| STRATA | BANK | BOAT | OTHER | ALL | BANK | BOAT | OTHER | ALL |
| MARWD | 4.4 | 0.0 | 0.0 | 4.4 | 3.3 | 0.0 | 0.0 | 3.3 |
| MARWE | 3.9 | 0.0 | 0.0 | 3.9 | 1.9 | 0.0 | 0.0 | 1.9 |
| APRWE | 238.1 | 0.0 | 0.0 | 238.1 | 41.4 | 0.0 | 0.0 | 41.4 |
| APRWD | 325.1 | 0.0 | 0.0 | 325.1 | 134.7 | 0.0 | 0.0 | 134.7 |
| MAYWD | 476.0 | 0.0 | 0.0 | 476.0 | 61.0 | 0.0 | 0.0 | 61.0 |
| MAYWE | 77.9 | 0.0 | 0.0 | 77.9 | 0.0 | 0.0 | 0.0 | 0.0 |
| JUNWD | 78.2 | 0.0 | 0.0 | 78.2 | 41.2 | 0.0 | 0.0 | 41.2 |
| JUNWE | 51.5 | 0.0 | 0.0 | 51.5 | 0.0 | 0.0 | 0.0 | 0.0 |
| JULWE | 16.1 | 0.0 | 0.0 | 16.1 | 0.0 | 0.0 | 0.0 | 0.0 |
| JULWD | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| AUGWD | 28.1 | 0.0 | 0.0 | 28.1 | 13.3 | 0.0 | 0.0 | 13.3 |
| AUGWE | 8.4 | 0.0 | 0.0 | 8.4 | 0.0 | 0.0 | 0.0 | 0.0 |
| ALL | 1307.7 | 0.0 | 0.0 | 1307.7 | 141.5 | 0.0 | 0.0 | 141.5 |

RETURNED CATCH/HR SPC RBT Water 54851 Year 2006 Stat Method 1

| | Estimate | | | | Std Error | | | |
|---|---|---|---|---|---|---|---|---|
| STRATA | BANK | BOAT | OTHER | ALL | BANK | BOAT | OTHER | ALL |
| MARWD | 0.011 | 0.000 | 0.000 | 0.011 | 0.000 | 0.000 | 0.000 | 0.000 |
| MARWE | 0.020 | 0.000 | 0.000 | 0.020 | 0.000 | 0.000 | 0.000 | 0.000 |
| APRWE | 0.305 | 0.000 | 0.000 | 0.305 | 0.045 | 0.000 | 0.000 | 0.045 |
| APRWD | 0.370 | 0.000 | 0.000 | 0.368 | 0.076 | 0.000 | 0.000 | 0.076 |
| MAYWD | 0.235 | 0.000 | 0.000 | 0.223 | 0.046 | 0.000 | 0.000 | 0.042 |
| MAYWE | 0.034 | 0.000 | 0.000 | 0.033 | 0.000 | 0.000 | 0.000 | 0.000 |
| JUNWD | 0.034 | 0.000 | 0.000 | 0.034 | 0.015 | 0.000 | 0.000 | 0.015 |
| JUNWE | 0.020 | 0.000 | 0.000 | 0.020 | 0.000 | 0.000 | 0.000 | 0.000 |
| JULWE | 0.007 | 0.000 | 0.000 | 0.007 | 0.000 | 0.000 | 0.000 | 0.000 |
| JULWD | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| AUGWD | 0.015 | 0.000 | 0.000 | 0.015 | 0.007 | 0.000 | 0.000 | 0.007 |
| AUGWE | 0.007 | 0.000 | 0.000 | 0.007 | 0.000 | 0.000 | 0.000 | 0.000 |
| ALL | 0.068 | 0.000 | 0.000 | 0.067 | 0.000 | 0.000 | 0.000 | 0.000 |

Average Kept Catch Size (In INCH) SPC RBT Water 54851 Year 2006 Stat Method 1

| | Estimate | | | | |
|---|---|---|---|---|---|
| STRATA | BANK | BOAT | OTHER | ALL | |
| MARWD | 11.7 | 0.0 | 0.0 | 11.7 | |
| MARWE | 13.0 | 0.0 | 0.0 | 13.0 | |
| APRWE | 11.6 | 0.0 | 0.0 | 11.6 | |
| APRWD | 10.8 | 0.0 | 0.0 | 10.8 | |
| MAYWD | 12.0 | 0.0 | 0.0 | 12.0 | |
| MAYWE | 12.0 | 0.0 | 0.0 | 12.0 | |
| JUNWD | 12.2 | 0.0 | 0.0 | 12.2 | |
| JUNWE | 12.0 | 0.0 | 0.0 | 12.0 | |
| JULWE | 12.0 | 0.0 | 0.0 | 12.0 | |
| JULWD | 12.4 | 0.0 | 0.0 | 12.4 | |
| AUGWD | 11.4 | 0.0 | 0.0 | 11.4 | |
| AUGWE | 11.1 | 0.0 | 0.0 | 11.1 | |
| ALL | 11.9 | 0.0 | 0.0 | 11.9 | |

Average Kept Catch Size (In CM) SPC RBT Water 54851 Year 2006 Stat Method 1

| | Estimate | | | | |
|---|---|---|---|---|---|
| STRATA | BANK | BOAT | OTHER | ALL | |
| MARWD | 29.65 | 0 | 0 | 29.65 | |
| MARWE | 33.02 | 0 | 0 | 33.02 | |
| APRWE | 29.47 | 0 | 0 | 29.47 | |
| APRWD | 27.38 | 0 | 0 | 27.38 | |
| MAYWD | 30.58 | 0 | 0 | 30.58 | |
| MAYWE | 30.58 | 0 | 0 | 30.58 | |
| JUNWD | 30.94 | 0 | 0 | 30.94 | |
| JUNWE | 30.55 | 0 | 0 | 30.55 | |
| JULWE | 30.35 | 0 | 0 | 30.35 | |
| JULWD | 31.52 | 0 | 0 | 31.52 | |
| AUGWD | 28.88 | 0 | 0 | 28.88 | |
| AUGWE | 28.14 | 0 | 0 | 28.14 | |
| ALL | 30.23 | 0 | 0 | 30.23 | |

Average Completed Trip Length Water 54851 Year 2006 Stat Method

| | Estimate | | | | |
|---|---|---|---|---|---|
| STRATA | BANK | BOAT | OTHER | ALL | |
| MARWD | 2.1 | 0.0 | 0.0 | 2.1 | |
| MARWE | 1.7 | 0.0 | 0.0 | 1.7 | |
| APRWE | 3.0 | 0.0 | 0.0 | 3.0 | |
| APRWD | 2.9 | 0.0 | 0.0 | 2.9 | |
| MAYWD | 3.1 | 0.0 | 0.0 | 3.1 | |
| MAYWE | 2.5 | 0.0 | 0.0 | 2.5 | |
| JUNWD | 1.8 | 0.0 | 0.0 | 1.8 | |
| JUNWE | 2.4 | 0.0 | 0.0 | 2.4 | |
| JULWE | 2.9 | 0.0 | 0.0 | 2.9 | |
| JULWD | 2.2 | 0.0 | 0.0 | 2.2 | |
| AUGWD | 2.2 | 0.0 | 0.0 | 2.2 | |
| AUGWE | 3.2 | 0.0 | 0.0 | 3.2 | |
| ALL | 2.6 | 0.0 | 0.0 | 2.6 | |

SUMMARY SPC RBT Water 54851 Year 2006 Stat Method 1

| | Estimate | | | | Std Error | | | |
|---|---|---|---|---|---|---|---|---|
| REPORT | BANK | BOAT | OTHER | ALL | BANK | BOAT | OTHER | ALL |
| Total Catch | 8761.0 | 0.0 | 0.0 | 8761.0 | 430.3 | 0.0 | 0.0 | 430.3 |
| Total Catch/hour | 0.454 | 0.000 | 0.000 | 0.451 | 0.000 | 0.000 | 0.000 | 0.000 |
| Kept catch | 7453.3 | 0.0 | 0.0 | 7453.3 | 368.7 | 0.0 | 0.0 | 368.7 |
| Kept Catch/hour | 0.386 | 0.000 | 0.000 | 0.383 | 0.000 | 0.000 | 0.000 | 0.000 |
| Returned Catch | 1307.7 | 0.0 | 0.0 | 1307.7 | 141.5 | 0.0 | 0.0 | 141.5 |
| Returned Catch/hour | 0.068 | 0.000 | 0.000 | 0.067 | 0.000 | 0.000 | 0.000 | 0.000 |
| Average Kept Catch Size (INCH) | 11.9 | 0.0 | 0.0 | 11.9 | | | | |
| Average Kept Catch Size (CM) | 30.32 | 0 | 0 | 30.32 | | | | |
| Average Trip Length | 2.6 | 0.0 | 0.0 | 2.6 | | | | |

FISHERMAN-HOURS Water 55928 Year 2006 Stat Method N/A

| | Estimate | | | | Std Error | | | |
|---|---|---|---|---|---|---|---|---|
| STRATA | BANK | BOAT | OTHER | ALL | BANK | BOAT | OTHER | ALL |
| MARWD | 792.7 | 0.0 | 0.0 | 792.7 | 419.8 | 0.0 | 0.0 | 419.8 |
| MARWE | 457.6 | 0.0 | 0.0 | 457.6 | 239.0 | 0.0 | 0.0 | 239.0 |
| APRWE | 1037.7 | 129.1 | 17.1 | 1184.0 | 264.9 | 56.4 | 11.4 | 311.5 |
| APRWD | 654.0 | 96.0 | 0.0 | 750.0 | 134.8 | 40.6 | 0.0 | 154.7 |
| MAYWD | 2392.0 | 445.8 | 87.0 | 2924.8 | 831.9 | 191.2 | 50.6 | 988.4 |
| MAYWE | 3312.4 | 338.0 | 83.2 | 3733.6 | 310.4 | 77.7 | 33.4 | 333.1 |
| JUNWD | 2128.6 | 650.2 | 61.6 | 2840.4 | 217.1 | 119.8 | 39.8 | 295.7 |
| JUNWE | 3052.0 | 660.8 | 210.0 | 3922.8 | 434.4 | 78.3 | 37.4 | 516.5 |
| JULWE | 1982.4 | 616.7 | 112.0 | 2711.1 | 265.4 | 90.6 | 44.8 | 334.7 |
| JULWD | 1360.0 | 360.0 | 64.0 | 1784.0 | 145.5 | 169.3 | 41.3 | 173.9 |
| AUGWD | 1667.2 | 694.1 | 128.8 | 2490.1 | 393.3 | 134.0 | 70.4 | 390.3 |
| AUGWE | 1464.4 | 644.0 | 92.4 | 2200.8 | 226.9 | 84.4 | 43.5 | 267.2 |
| ALL | 20301.1 | 4634.7 | 856.1 | 25792.0 | 1282.1 | 360.3 | 131.7 | 1470.6 |

TOTAL CATCH Water 55928 Year 2006 Stat Method 1

| | Estimate | | | | Std Error | | | |
|---|---|---|---|---|---|---|---|---|
| STRATA | BANK | BOAT | OTHER | ALL | BANK | BOAT | OTHER | ALL |
| MARWD | 384.8 | 0.0 | 0.0 | 384.8 | 236.3 | 0.0 | 0.0 | 236.3 |
| MARWE | 75.6 | 0.0 | 0.0 | 75.6 | 55.4 | 0.0 | 0.0 | 55.4 |
| APRWE | 337.5 | 0.0 | 0.0 | 337.5 | 114.2 | 0.0 | 0.0 | 114.2 |
| APRWD | 387.7 | 0.0 | 0.0 | 387.7 | 184.8 | 0.0 | 0.0 | 184.8 |
| MAYWD | 1419.5 | 160.4 | 1.2 | 1581.2 | 350.1 | 133.8 | 1.2 | 434.8 |
| MAYWE | 1236.7 | 122.5 | 0.0 | 1359.1 | 294.3 | 40.5 | 0.0 | 297.1 |
| JUNWD | 877.5 | 387.0 | 0.0 | 1264.5 | 235.0 | 174.9 | 0.0 | 519.9 |
| JUNWE | 584.9 | 126.0 | 107.3 | 818.2 | 108.5 | 40.8 | 36.3 | 218.6 |
| JULWE | 302.0 | 42.1 | 0.0 | 344.0 | 63.8 | 33.7 | 0.0 | 88.5 |
| JULWD | 161.6 | 0.0 | 0.0 | 161.6 | 44.1 | 0.0 | 0.0 | 44.1 |
| AUGWD | 428.5 | 183.1 | 18.4 | 630.0 | 137.3 | 97.8 | 18.4 | 177.4 |
| AUGWE | 290.5 | 119.4 | 0.0 | 409.9 | 66.1 | 64.9 | 0.0 | 117.4 |
| ALL | 6486.8 | 1140.4 | 127.0 | 7754.2 | 641.5 | 258.3 | 40.7 | 869.8 |
| TOTAL CONTACTS: | | BANK = 775.0 | | BOAT = 74.0 | OTHER =11.0 | | ALL = 860.0 | |
| TOTAL HOURS: | | BANK = 4771.5 | | BOAT = 569.0 | OTHER =68.3 | | ALL = 5408.8 | |

TOTAL CATCH/HR Water 55928 Year 2006 Stat Method 1

| | Estimate | | | | Std Error | | | |
|---|---|---|---|---|---|---|---|---|
| STRATA | BANK | BOAT | OTHER | ALL | BANK | BOAT | OTHER | ALL |
| MARWD | 0.485 | 0.000 | 0.000 | 0.485 | 0.089 | 0.000 | 0.000 | 0.089 |
| MARWE | 0.165 | 0.000 | 0.000 | 0.165 | 0.043 | 0.000 | 0.000 | 0.043 |
| APRWE | 0.325 | 0.000 | 0.000 | 0.285 | 0.044 | 0.000 | 0.000 | 0.030 |
| APRWD | 0.593 | 0.000 | 0.000 | 0.517 | 0.206 | 0.000 | 0.000 | 0.176 |
| MAYWD | 0.593 | 0.360 | 0.014 | 0.541 | 0.167 | 0.161 | 0.016 | 0.115 |
| MAYWE | 0.373 | 0.362 | 0.000 | 0.364 | 0.078 | 0.121 | 0.000 | 0.362 |
| JUNWD | 0.412 | 0.595 | 0.000 | 0.445 | 0.104 | 0.202 | 0.000 | 0.172 |
| JUNWE | 0.192 | 0.191 | 0.511 | 0.209 | 0.021 | 0.053 | 0.227 | 0.048 |
| JULWE | 0.152 | 0.068 | 0.000 | 0.127 | 0.028 | 0.052 | 0.000 | 0.029 |
| JULWD | 0.119 | 0.000 | 0.000 | 0.091 | 0.032 | 0.000 | 0.000 | 0.022 |
| AUGWD | 0.257 | 0.264 | 0.143 | 0.253 | 0.053 | 0.166 | 0.062 | 0.069 |
| AUGWE | 0.198 | 0.185 | 0.000 | 0.186 | 0.038 | 0.118 | 0.000 | 0.057 |
| ALL | 0.320 | 0.246 | 0.148 | 0.301 | 0.016 | 0.048 | 0.044 | 0.056 |

CREEL CATCH Water 55928 Year 2006 Stat Method 1

| | Estimate | | | | Std Error | | | |
|---|---|---|---|---|---|---|---|---|
| STRATA | BANK | BOAT | OTHER | ALL | BANK | BOAT | OTHER | ALL |
| MARWD | 110.3 | 0.0 | 0.0 | 110.3 | 46.1 | 0.0 | 0.0 | 46.1 |
| MARWE | 30.3 | 0.0 | 0.0 | 30.3 | 20.3 | 0.0 | 0.0 | 20.3 |
| APRWE | 255.1 | 0.0 | 0.0 | 255.1 | 112.7 | 0.0 | 0.0 | 112.7 |
| APRWD | 181.3 | 0.0 | 0.0 | 181.3 | 61.9 | 0.0 | 0.0 | 61.9 |
| MAYWD | 1219.9 | 160.4 | 1.2 | 1381.6 | 312.4 | 133.8 | 1.2 | 405.0 |
| MAYWE | 1196.2 | 122.5 | 0.0 | 1318.7 | 293.9 | 40.5 | 0.0 | 296.6 |
| JUNWD | 877.5 | 387.0 | 0.0 | 1264.5 | 235.0 | 174.9 | 0.0 | 519.9 |
| JUNWE | 551.1 | 123.5 | 107.3 | 781.9 | 108.5 | 40.5 | 36.3 | 215.2 |
| JULWE | 299.8 | 42.1 | 0.0 | 341.9 | 64.4 | 33.7 | 0.0 | 88.9 |
| JULWD | 156.7 | 0.0 | 0.0 | 156.7 | 44.8 | 0.0 | 0.0 | 44.8 |
| AUGWD | 411.5 | 183.1 | 18.4 | 613.0 | 130.6 | 97.8 | 18.4 | 175.2 |
| AUGWE | 272.7 | 101.5 | 0.0 | 374.2 | 58.5 | 52.9 | 0.0 | 98.9 |
| ALL | 5562.3 | 1120.0 | 127.0 | 6809.3 | 544.6 | 255.5 | 40.7 | 798.8 |

CREEL CATCH/HR Water 55928 Year 2006 Stat Method 1

| | Estimate | | | | Std Error | | | |
|---|---|---|---|---|---|---|---|---|
| STRATA | BANK | BOAT | OTHER | ALL | BANK | BOAT | OTHER | ALL |
| MARWD | 0.139 | 0.000 | 0.000 | 0.139 | 0.058 | 0.000 | 0.000 | 0.058 |
| MARWE | 0.066 | 0.000 | 0.000 | 0.066 | 0.013 | 0.000 | 0.000 | 0.013 |
| APRWE | 0.246 | 0.000 | 0.000 | 0.215 | 0.074 | 0.000 | 0.000 | 0.056 |
| APRWD | 0.277 | 0.000 | 0.000 | 0.242 | 0.075 | 0.000 | 0.000 | 0.068 |
| MAYWD | 0.510 | 0.360 | 0.014 | 0.472 | 0.127 | 0.161 | 0.016 | 0.085 |
| MAYWE | 0.361 | 0.362 | 0.000 | 0.353 | 0.077 | 0.121 | 0.000 | 0.351 |
| JUNWD | 0.412 | 0.595 | 0.000 | 0.445 | 0.104 | 0.202 | 0.000 | 0.172 |
| JUNWE | 0.181 | 0.187 | 0.511 | 0.199 | 0.017 | 0.052 | 0.227 | 0.046 |
| JULWE | 0.151 | 0.068 | 0.000 | 0.126 | 0.029 | 0.052 | 0.000 | 0.030 |
| JULWD | 0.115 | 0.000 | 0.000 | 0.088 | 0.033 | 0.000 | 0.000 | 0.023 |
| AUGWD | 0.247 | 0.264 | 0.143 | 0.246 | 0.057 | 0.166 | 0.062 | 0.071 |
| AUGWE | 0.186 | 0.158 | 0.000 | 0.170 | 0.035 | 0.097 | 0.000 | 0.048 |
| ALL | 0.274 | 0.242 | 0.148 | 0.264 | 0.014 | 0.047 | 0.044 | 0.055 |

RETURNED CATCH Water 55928 Year 2006 Stat Method 1

| | Estimate | | | | Std Error | | | |
|---|---|---|---|---|---|---|---|---|
| STRATA | BANK | BOAT | OTHER | ALL | BANK | BOAT | OTHER | ALL |
| MARWD | 274.5 | 0.0 | 0.0 | 274.5 | 202.1 | 0.0 | 0.0 | 202.1 |
| MARWE | 45.3 | 0.0 | 0.0 | 45.3 | 35.2 | 0.0 | 0.0 | 35.2 |
| APRWE | 82.4 | 0.0 | 0.0 | 82.4 | 42.1 | 0.0 | 0.0 | 42.1 |
| APRWD | 206.4 | 0.0 | 0.0 | 206.4 | 143.6 | 0.0 | 0.0 | 143.6 |
| MAYWD | 199.6 | 0.0 | 0.0 | 199.6 | 99.0 | 0.0 | 0.0 | 99.0 |
| MAYWE | 40.5 | 0.0 | 0.0 | 40.5 | 19.9 | 0.0 | 0.0 | 19.9 |
| JUNWD | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| JUNWE | 33.8 | 2.5 | 0.0 | 36.3 | 33.8 | 2.5 | 0.0 | 36.3 |
| JULWE | 2.2 | 0.0 | 0.0 | 2.2 | 2.2 | 0.0 | 0.0 | 2.2 |
| JULWD | 5.0 | 0.0 | 0.0 | 5.0 | 5.0 | 0.0 | 0.0 | 5.0 |
| AUGWD | 17.0 | 0.0 | 0.0 | 17.0 | 17.0 | 0.0 | 0.0 | 17.0 |
| AUGWE | 17.8 | 17.9 | 0.0 | 35.7 | 11.7 | 12.2 | 0.0 | 20.8 |
| ALL | 924.6 | 20.4 | 0.0 | 944.9 | 276.1 | 12.5 | 0.0 | 277.0 |

RETURNED CATCH/HR Water 55928 Year 2006 Stat Method 1

| | Estimate | | | | Std Error | | | |
|---|---|---|---|---|---|---|---|---|
| STRATA | BANK | BOAT | OTHER | ALL | BANK | BOAT | OTHER | ALL |
| MARWD | 0.346 | 0.000 | 0.000 | 0.346 | 0.086 | 0.000 | 0.000 | 0.086 |
| MARWE | 0.099 | 0.000 | 0.000 | 0.099 | 0.031 | 0.000 | 0.000 | 0.031 |
| APRWE | 0.079 | 0.000 | 0.000 | 0.070 | 0.035 | 0.000 | 0.000 | 0.033 |
| APRWD | 0.316 | 0.000 | 0.000 | 0.275 | 0.179 | 0.000 | 0.000 | 0.153 |
| MAYWD | 0.083 | 0.000 | 0.000 | 0.068 | 0.053 | 0.000 | 0.000 | 0.042 |
| MAYWE | 0.012 | 0.000 | 0.000 | 0.011 | 0.000 | 0.000 | 0.000 | 0.011 |
| JUNWD | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| JUNWE | 0.011 | 0.004 | 0.000 | 0.009 | 0.012 | 0.000 | 0.000 | 0.000 |
| JULWE | 0.001 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 |
| JULWD | 0.004 | 0.000 | 0.000 | 0.003 | 0.000 | 0.000 | 0.000 | 0.000 |
| AUGWD | 0.010 | 0.000 | 0.000 | 0.007 | 0.000 | 0.000 | 0.000 | 0.000 |
| AUGWE | 0.012 | 0.028 | 0.000 | 0.016 | 0.000 | 0.022 | 0.000 | 0.000 |
| ALL | 0.046 | 0.004 | 0.000 | 0.037 | 0.013 | 0.000 | 0.000 | 0.010 |

FISHERMAN Water 55928 Year 2006 Stat Method 1

| | Estimate | | | | Std Error | | | |
|---|---|---|---|---|---|---|---|---|
| STRATA | BANK | BOAT | OTHER | ALL | BANK | BOAT | OTHER | ALL |
| MARWD | 296.6 | 0.0 | 0.0 | 296.6 | 172.8 | 0.0 | 0.0 | 172.8 |
| MARWE | 99.5 | 0.0 | 0.0 | 99.5 | 36.0 | 0.0 | 0.0 | 36.0 |
| APRWE | 142.7 | 0.0 | 0.0 | 142.7 | 31.5 | 0.0 | 0.0 | 31.5 |
| APRWD | 200.0 | 28.8 | 0.0 | 228.8 | 32.6 | 28.8 | 0.0 | 45.7 |
| MAYWD | 619.7 | 133.2 | 0.6 | 753.5 | 177.8 | 81.5 | 0.6 | 268.2 |
| MAYWE | 608.0 | 36.9 | 1.2 | 646.1 | 123.4 | 3.8 | 1.2 | 123.4 |
| JUNWD | 498.0 | 280.6 | 0.0 | 778.6 | 67.6 | 125.2 | 0.0 | 283.6 |
| JUNWE | 408.9 | 173.3 | 410.2 | 992.4 | 54.9 | 57.2 | 371.1 | 451.5 |
| JULWE | 288.8 | 142.5 | 10.3 | 441.5 | 41.9 | 20.3 | 10.3 | 123.4 |
| JULWD | 304.0 | 104.1 | 0.0 | 408.1 | 43.9 | 92.1 | 0.0 | 136.3 |
| AUGWD | 378.5 | 97.4 | 18.4 | 494.3 | 88.0 | 22.4 | 18.4 | 121.7 |
| AUGWE | 309.8 | 89.0 | 5.0 | 403.7 | 100.6 | 15.9 | 5.0 | 124.2 |
| ALL | 4154.5 | 1085.8 | 445.6 | 5685.9 | 330.4 | 189.9 | 371.7 | 685.3 |

Average Kept Catch Size (In INCH) Water 55928 Year 2006 Stat Method 1

| | Estimate | | | |
|---|---|---|---|---|
| STRATA | BANK | BOAT | OTHER | ALL |
| MARWD | 11.8 | 0.0 | 0.0 | 11.8 |
| MARWE | 12.0 | 0.0 | 0.0 | 12.0 |
| APRWE | 11.4 | 0.0 | 0.0 | 11.4 |
| APRWD | 13.7 | 0.0 | 0.0 | 13.7 |
| MAYWD | 12.5 | 12.5 | 12.3 | 12.5 |
| MAYWE | 12.1 | 12.9 | 0.0 | 12.1 |
| JUNWD | 11.9 | 13.1 | 0.0 | 12.3 |
| JUNWE | 12.1 | 13.2 | 13.1 | 12.4 |
| JULWE | 13.1 | 12.3 | 0.0 | 13.0 |
| JULWD | 12.4 | 0.0 | 0.0 | 12.4 |
| AUGWD | 12.2 | 12.5 | 16.0 | 12.4 |
| AUGWE | 11.4 | 13.6 | 0.0 | 12.0 |
| ALL | 12.2 | 12.9 | 13.5 | 12.4 |

Average Kept Catch Size (In CM) Water 55928 Year 2006 Stat Method 1

| | Estimate | | | | |
|---|---|---|---|---|---|
| STRATA | BANK | BOAT | OTHER | ALL | |
| MARWD | 30.08 | 0 | 0 | 30.08 | |
| MARWE | 30.49 | 0 | 0 | 30.49 | |
| APRWE | 28.98 | 0 | 0 | 28.98 | |
| APRWD | 34.88 | 0 | 0 | 34.88 | |
| MAYWD | 31.81 | 31.88 | 31.12 | 31.82 | |
| MAYWE | 30.67 | 32.69 | 0 | 30.86 | |
| JUNWD | 30.16 | 33.34 | 0 | 31.13 | |
| JUNWE | 30.76 | 33.57 | 33.17 | 31.54 | |
| JULWE | 33.3 | 31.27 | 0 | 33.05 | |
| JULWD | 31.39 | 0 | 0 | 31.39 | |
| AUGWD | 31.04 | 31.67 | 40.64 | 31.52 | |
| AUGWE | 29.01 | 34.53 | 0 | 30.5 | |
| ALL | 30.99 | 32.77 | 34.29 | 31.5 | |

Average Completed Trip Length Water 55928 Year 2006 Stat Method

| | Estimate | | | | |
|---|---|---|---|---|---|
| STRATA | BANK | BOAT | OTHER | ALL | |
| MARWD | 2.4 | 0.0 | 0.0 | 2.4 | |
| MARWE | 2.5 | 0.0 | 0.0 | 2.5 | |
| APRWE | 2.7 | 0.0 | 0.0 | 2.7 | |
| APRWD | 2.2 | 2.0 | 5.0 | 2.4 | |
| MAYWD | 2.5 | 3.6 | 4.0 | 2.9 | |
| MAYWE | 3.7 | 5.4 | 3.0 | 4.1 | |
| JUNWD | 2.8 | 3.4 | 0.0 | 3.0 | |
| JUNWE | 3.3 | 4.4 | 4.5 | 3.5 | |
| JULWE | 4.2 | 2.2 | 0.0 | 3.9 | |
| JULWD | 3.0 | 4.1 | 0.0 | 3.2 | |
| AUGWD | 2.9 | 4.0 | 7.0 | 3.3 | |
| AUGWE | 3.5 | 3.8 | 0.0 | 3.6 | |
| ALL | 3.1 | 3.9 | 4.3 | 3.3 | |

SUMMARY Water 55928 Year 2006 Stat Method 1

| | Estimate | | | | Std Error | | | |
|---|---|---|---|---|---|---|---|---|
| REPORT | BANK | BOAT | OTHER | ALL | BANK | BOAT | OTHER | ALL |
| Fisherman Hours | 20301.1 | 4634.7 | 856.1 | 25792.0 | 1282.1 | 360.3 | 131.7 | 1470.6 |
| Total Catch | 6486.8 | 1140.4 | 127.0 | 7754.2 | 641.5 | 258.3 | 40.7 | 869.8 |
| Total Catch/hour | 0.320 | 0.246 | 0.148 | 0.301 | 0.016 | 0.048 | 0.044 | 0.056 |
| Kept catch | 5562.3 | 1120.0 | 127.0 | 6809.3 | 544.6 | 255.5 | 40.7 | 798.8 |
| Kept Catch/hour | 0.274 | 0.242 | 0.148 | 0.264 | 0.014 | 0.047 | 0.044 | 0.055 |
| Returned Catch | 924.6 | 20.4 | 0.0 | 944.9 | 276.1 | 12.5 | 0.0 | 277.0 |
| Returned Catch/hour | 0.046 | 0.004 | 0.000 | 0.037 | 0.013 | 0.000 | 0.000 | 0.010 |
| Fisherman | 4154.5 | 1085.8 | 445.6 | 5685.9 | 330.4 | 189.9 | 371.7 | 685.3 |
| Average Kept Catch Size (INCH) | 12.2 | 12.9 | 13.5 | 12.4 | | | | |
| Average Kept Catch Size (CM) | 30.99 | 32.77 | 34.29 | 31.5 | | | | |
| Average Trip Length | 3.1 | 3.9 | 4.3 | 3.3 | | | | |

TOTAL CATCH SPC CUT Water 55928 Year 2006 Stat Method 1

| | Estimate | | | | Std Error | | | |
|---|---|---|---|---|---|---|---|---|
| STRATA | BANK | BOAT | OTHER | ALL | BANK | BOAT | OTHER | ALL |
| MARWD | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| MARWE | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| APRWE | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| APRWD | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| MAYWD | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| MAYWE | 13.4 | 0.0 | 0.0 | 13.4 | 9.2 | 0.0 | 0.0 | 9.2 |
| JUNWD | 0.0 | 6.8 | 0.0 | 6.8 | 0.0 | 6.8 | 0.0 | 6.8 |
| JUNWE | 0.0 | 2.5 | 0.0 | 2.5 | 0.0 | 2.5 | 0.0 | 2.5 |
| JULWE | 1.6 | 0.0 | 0.0 | 1.6 | 1.6 | 0.0 | 0.0 | 1.6 |
| JULWD | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| AUGWD | 100.0 | 128.5 | 18.4 | 246.9 | 43.9 | 89.4 | 18.4 | 118.1 |
| AUGWE | 91.9 | 4.0 | 0.0 | 95.9 | 43.7 | 4.0 | 0.0 | 42.5 |
| ALL | 207.0 | 141.8 | 18.4 | 367.2 | 62.7 | 89.8 | 18.4 | 126.0 |
| TOTAL CONTACTS: | | BANK = 775.0 | | BOAT = 74.0 | OTHER =11.0 | | ALL = 860.0 | |
| TOTAL HOURS: | | BANK = 4771.5 | | BOAT = 569.0 | OTHER =68.3 | | ALL = 5408.8 | |

TOTAL CATCH/HR SPC CUT Water 55928 Year 2006 Stat Method 1

| | Estimate | | | | Std Error | | | |
|---|---|---|---|---|---|---|---|---|
| STRATA | BANK | BOAT | OTHER | ALL | BANK | BOAT | OTHER | ALL |
| MARWD | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| MARWE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| APRWE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| APRWD | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| MAYWD | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| MAYWE | 0.004 | 0.000 | 0.000 | 0.004 | 0.000 | 0.000 | 0.000 | 0.000 |
| JUNWD | 0.000 | 0.011 | 0.000 | 0.002 | 0.000 | 0.011 | 0.000 | 0.000 |
| JUNWE | 0.000 | 0.004 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 |
| JULWE | 0.001 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 |
| JULWD | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| AUGWD | 0.060 | 0.185 | 0.143 | 0.099 | 0.034 | 0.142 | 0.062 | 0.057 |
| AUGWE | 0.063 | 0.006 | 0.000 | 0.044 | 0.033 | 0.000 | 0.000 | 0.022 |
| ALL | 0.010 | 0.031 | 0.021 | 0.014 | 0.000 | 0.020 | 0.020 | 0.000 |

CREEL CATCH SPC CUT Water 55928 Year 2006 Stat Method 1

| | Estimate | | | | Std Error | | | |
|---|---|---|---|---|---|---|---|---|
| STRATA | BANK | BOAT | OTHER | ALL | BANK | BOAT | OTHER | ALL |
| MARWD | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| MARWE | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| APRWE | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| APRWD | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| MAYWD | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| MAYWE | 13.4 | 0.0 | 0.0 | 13.4 | 9.2 | 0.0 | 0.0 | 9.2 |
| JUNWD | 0.0 | 6.8 | 0.0 | 6.8 | 0.0 | 6.8 | 0.0 | 6.8 |
| JUNWE | 0.0 | 2.5 | 0.0 | 2.5 | 0.0 | 2.5 | 0.0 | 2.5 |
| JULWE | 1.6 | 0.0 | 0.0 | 1.6 | 1.6 | 0.0 | 0.0 | 1.6 |
| JULWD | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| AUGWD | 100.0 | 128.5 | 18.4 | 246.9 | 43.9 | 89.4 | 18.4 | 118.1 |
| AUGWE | 88.7 | 4.0 | 0.0 | 92.7 | 42.3 | 4.0 | 0.0 | 41.3 |
| ALL | 203.7 | 141.8 | 18.4 | 363.9 | 61.7 | 89.8 | 18.4 | 125.6 |

CREEL CATCH/HR SPC CUT Water 55928 Year 2006 Stat Method 1

| | Estimate | | | | Std Error | | | |
|---|---|---|---|---|---|---|---|---|
| STRATA | BANK | BOAT | OTHER | ALL | BANK | BOAT | OTHER | ALL |
| MARWD | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| MARWE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| APRWE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| APRWD | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| MAYWD | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| MAYWE | 0.004 | 0.000 | 0.000 | 0.004 | 0.000 | 0.000 | 0.000 | 0.000 |
| JUNWD | 0.000 | 0.011 | 0.000 | 0.002 | 0.000 | 0.011 | 0.000 | 0.000 |
| JUNWE | 0.000 | 0.004 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 |
| JULWE | 0.001 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 |
| JULWD | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| AUGWD | 0.060 | 0.185 | 0.143 | 0.099 | 0.034 | 0.142 | 0.062 | 0.057 |
| AUGWE | 0.061 | 0.006 | 0.000 | 0.042 | 0.032 | 0.000 | 0.000 | 0.021 |
| ALL | 0.010 | 0.031 | 0.021 | 0.014 | 0.000 | 0.020 | 0.020 | 0.000 |

RETURNED CATCH SPC CUT Water 55928 Year 2006 Stat Method 1

| | Estimate | | | | Std Error | | | |
|---|---|---|---|---|---|---|---|---|
| STRATA | BANK | BOAT | OTHER | ALL | BANK | BOAT | OTHER | ALL |
| MARWD | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| MARWE | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| APRWE | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| APRWD | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| MAYWD | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| MAYWE | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| JUNWD | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| JUNWE | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| JULWE | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| JULWD | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| AUGWD | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| AUGWE | 3.2 | 0.0 | 0.0 | 3.2 | 3.2 | 0.0 | 0.0 | 3.2 |
| ALL | 3.2 | 0.0 | 0.0 | 3.2 | 3.2 | 0.0 | 0.0 | 3.2 |

RETURNED CATCH/HR SPC CUT Water 55928 Year 2006 Stat Method 1

| | Estimate | | | | Std Error | | | |
|---|---|---|---|---|---|---|---|---|
| STRATA | BANK | BOAT | OTHER | ALL | BANK | BOAT | OTHER | ALL |
| MARWD | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| MARWE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| APRWE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| APRWD | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| MAYWD | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| MAYWE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| JUNWD | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| JUNWE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| JULWE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| JULWD | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| AUGWD | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| AUGWE | 0.002 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 |
| ALL | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |

Average Kept Catch Size (In INCH) SPC CUT Water 55928 Year 2006 Stat Method 1

| | | Estimate | | | |
|---|---|---|---|---|---|
| STRATA | BANK | BOAT | OTHER | ALL | |
| MARWD | 0.0 | 0.0 | 0.0 | 0.0 | |
| MARWE | 0.0 | 0.0 | 0.0 | 0.0 | |
| APRWE | 0.0 | 0.0 | 0.0 | 0.0 | |
| APRWD | 0.0 | 0.0 | 0.0 | 0.0 | |
| MAYWD | 0.0 | 0.0 | 0.0 | 0.0 | |
| MAYWE | 13.3 | 0.0 | 0.0 | 13.3 | |
| JUNWD | 0.0 | 13.0 | 0.0 | 13.0 | |
| JUNWE | 0.0 | 13.0 | 0.0 | 13.0 | |
| JULWE | 14.0 | 0.0 | 0.0 | 14.0 | |
| JULWD | 0.0 | 0.0 | 0.0 | 0.0 | |
| AUGWD | 11.2 | 12.1 | 16.0 | 12.0 | |
| AUGWE | 11.6 | 13.0 | 0.0 | 11.7 | |
| ALL | 11.5 | 12.1 | 16.0 | 12.0 | |

Average Kept Catch Size (In CM) SPC CUT Water 55928 Year 2006 Stat Method 1

| | | Estimate | | | |
|---|---|---|---|---|---|
| STRATA | BANK | BOAT | OTHER | ALL | |
| MARWD | 0 | 0 | 0 | 0 | |
| MARWE | 0 | 0 | 0 | 0 | |
| APRWE | 0 | 0 | 0 | 0 | |
| APRWD | 0 | 0 | 0 | 0 | |
| MAYWD | 0 | 0 | 0 | 0 | |
| MAYWE | 33.83 | 0 | 0 | 33.83 | |
| JUNWD | 0 | 33.02 | 0 | 33.02 | |
| JUNWE | 0 | 33.02 | 0 | 33.02 | |
| JULWE | 35.56 | 0 | 0 | 35.56 | |
| JULWD | 0 | 0 | 0 | 0 | |
| AUGWD | 28.34 | 30.63 | 40.64 | 30.45 | |
| AUGWE | 29.57 | 33.02 | 0 | 29.72 | |
| ALL | 29.21 | 30.73 | 40.64 | 30.48 | |

Average Completed Trip Length Water 55928 Year 2006 Stat Method

| | | Estimate | | | |
|---|---|---|---|---|---|
| STRATA | BANK | BOAT | OTHER | ALL | |
| MARWD | 2.4 | 0.0 | 0.0 | 2.4 | |
| MARWE | 2.5 | 0.0 | 0.0 | 2.5 | |
| APRWE | 2.7 | 0.0 | 0.0 | 2.7 | |
| APRWD | 2.2 | 2.0 | 5.0 | 2.4 | |
| MAYWD | 2.5 | 3.6 | 4.0 | 2.9 | |
| MAYWE | 3.7 | 5.4 | 3.0 | 4.1 | |
| JUNWD | 2.8 | 3.4 | 0.0 | 3.0 | |
| JUNWE | 3.3 | 4.4 | 4.5 | 3.5 | |
| JULWE | 4.2 | 2.2 | 0.0 | 3.9 | |
| JULWD | 3.0 | 4.1 | 0.0 | 3.2 | |
| AUGWD | 2.9 | 4.0 | 7.0 | 3.3 | |
| AUGWE | 3.5 | 3.8 | 0.0 | 3.6 | |
| ALL | 3.1 | 3.9 | 4.3 | 3.3 | |

SUMMARY SPC CUT Water 55928 Year 2006 Stat Method 1

| | Estimate | | | | Std Error | | | |
|---|---|---|---|---|---|---|---|---|
| REPORT | BANK | BOAT | OTHER | ALL | BANK | BOAT | OTHER | ALL |
| Total Catch | 207.0 | 141.8 | 18.4 | 367.2 | 62.7 | 89.8 | 18.4 | 126.0 |
| Total Catch/hour | 0.010 | 0.031 | 0.021 | 0.014 | 0.000 | 0.020 | 0.020 | 0.000 |
| Kept catch | 203.7 | 141.8 | 18.4 | 363.9 | 61.7 | 89.8 | 18.4 | 125.6 |
| Kept Catch/hour | 0.010 | 0.031 | 0.021 | 0.014 | 0.000 | 0.020 | 0.020 | 0.000 |
| Returned Catch | 3.2 | 0.0 | 0.0 | 3.2 | 3.2 | 0.0 | 0.0 | 3.2 |
| Returned Catch/hour | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Average Kept Catch Size (INCH) | 11.5 | 12.1 | 16.0 | 12.0 | | | | |
| Average Kept Catch Size (CM) | 29.3 | 30.86 | 40.64 | 30.48 | | | | |
| Average Trip Length | 3.1 | 3.9 | 4.3 | 3.3 | | | | |

TOTAL CATCH SPC KOK Water 55928 Year 2006 Stat Method 1

| | Estimate | | | | Std Error | | | |
|---|---|---|---|---|---|---|---|---|
| STRATA | BANK | BOAT | OTHER | ALL | BANK | BOAT | OTHER | ALL |
| MARWD | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| MARWE | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| APRWE | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| APRWD | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| MAYWD | 16.0 | 0.0 | 0.0 | 16.0 | 16.0 | 0.0 | 0.0 | 16.0 |
| MAYWE | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| JUNWD | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| JUNWE | 0.0 | 6.7 | 0.0 | 6.7 | 0.0 | 6.7 | 0.0 | 6.7 |
| JULWE | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| JULWD | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| AUGWD | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| AUGWE | 2.6 | 0.0 | 0.0 | 2.6 | 2.6 | 0.0 | 0.0 | 2.6 |
| ALL | 18.7 | 6.7 | 0.0 | 25.4 | 16.2 | 6.7 | 0.0 | 17.6 |
| TOTAL CONTACTS: | BANK = 775.0 | BOAT = 74.0 | | | OTHER =11.0 | ALL = 860.0 | | |
| TOTAL HOURS: | BANK = 4771.5 | BOAT = 569.0 | | | OTHER =68.3 | ALL = 5408.8 | | |

TOTAL CATCH/HR SPC KOK Water 55928 Year 2006 Stat Method 1

| | Estimate | | | | Std Error | | | |
|---|---|---|---|---|---|---|---|---|
| STRATA | BANK | BOAT | OTHER | ALL | BANK | BOAT | OTHER | ALL |
| MARWD | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| MARWE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| APRWE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| APRWD | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| MAYWD | 0.007 | 0.000 | 0.000 | 0.005 | 0.000 | 0.000 | 0.000 | 0.000 |
| MAYWE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| JUNWD | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| JUNWE | 0.000 | 0.010 | 0.000 | 0.002 | 0.000 | 0.011 | 0.000 | 0.000 |
| JULWE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| JULWD | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| AUGWD | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| AUGWE | 0.002 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 |
| ALL | 0.001 | 0.001 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 |

CREEL CATCH SPC KOK Water 55928 Year 2006 Stat Method 1

| | Estimate | | | | Std Error | | | |
|---|---|---|---|---|---|---|---|---|
| STRATA | BANK | BOAT | OTHER | ALL | BANK | BOAT | OTHER | ALL |
| MARWD | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| MARWE | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| APRWE | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| APRWD | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| MAYWD | 16.0 | 0.0 | 0.0 | 16.0 | 16.0 | 0.0 | 0.0 | 16.0 |
| MAYWE | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| JUNWD | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| JUNWE | 0.0 | 6.7 | 0.0 | 6.7 | 0.0 | 6.7 | 0.0 | 6.7 |
| JULWE | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| JULWD | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| AUGWD | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| AUGWE | 2.6 | 0.0 | 0.0 | 2.6 | 2.6 | 0.0 | 0.0 | 2.6 |
| ALL | 18.7 | 6.7 | 0.0 | 25.4 | 16.2 | 6.7 | 0.0 | 17.6 |

CREEL CATCH/HR SPC KOK Water 55928 Year 2006 Stat Method 1

| | Estimate | | | | Std Error | | | |
|---|---|---|---|---|---|---|---|---|
| STRATA | BANK | BOAT | OTHER | ALL | BANK | BOAT | OTHER | ALL |
| MARWD | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| MARWE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| APRWE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| APRWD | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| MAYWD | 0.007 | 0.000 | 0.000 | 0.005 | 0.000 | 0.000 | 0.000 | 0.000 |
| MAYWE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| JUNWD | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| JUNWE | 0.000 | 0.010 | 0.000 | 0.002 | 0.000 | 0.011 | 0.000 | 0.000 |
| JULWE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| JULWD | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| AUGWD | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| AUGWE | 0.002 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 |
| ALL | 0.001 | 0.001 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 |

RETURNED CATCH SPC KOK Water 55928 Year 2006 Stat Method 1

| | Estimate | | | | Std Error | | | |
|---|---|---|---|---|---|---|---|---|
| STRATA | BANK | BOAT | OTHER | ALL | BANK | BOAT | OTHER | ALL |
| MARWD | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| MARWE | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| APRWE | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| APRWD | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| MAYWD | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| MAYWE | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| JUNWD | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| JUNWE | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| JULWE | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| JULWD | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| AUGWD | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| AUGWE | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| ALL | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |

RETURNED CATCH/HR SPC KOK Water 55928 Year 2006 Stat Method 1

| | Estimate | | | | Std Error | | | |
|---|---|---|---|---|---|---|---|---|
| STRATA | BANK | BOAT | OTHER | ALL | BANK | BOAT | OTHER | ALL |
| MARWD | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| MARWE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| APRWE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| APRWD | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| MAYWD | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| MAYWE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| JUNWD | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| JUNWE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| JULWE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| JULWD | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| AUGWD | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| AUGWE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| ALL | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |

Average Kept Catch Size (In INCH) SPC KOK Water 55928 Year 2006 Stat Method 1

| | Estimate | | | | |
|---|---|---|---|---|---|
| STRATA | BANK | BOAT | OTHER | ALL | |
| MARWD | 0.0 | 0.0 | 0.0 | 0.0 | |
| MARWE | 0.0 | 0.0 | 0.0 | 0.0 | |
| APRWE | 0.0 | 0.0 | 0.0 | 0.0 | |
| APRWD | 0.0 | 0.0 | 0.0 | 0.0 | |
| MAYWD | 11.5 | 0.0 | 0.0 | 11.5 | |
| MAYWE | 0.0 | 0.0 | 0.0 | 0.0 | |
| JUNWD | 0.0 | 0.0 | 0.0 | 0.0 | |
| JUNWE | 0.0 | 13.0 | 0.0 | 13.0 | |
| JULWE | 0.0 | 0.0 | 0.0 | 0.0 | |
| JULWD | 0.0 | 0.0 | 0.0 | 0.0 | |
| AUGWD | 0.0 | 0.0 | 0.0 | 0.0 | |
| AUGWE | 14.0 | 0.0 | 0.0 | 14.0 | |
| ALL | 11.9 | 13.0 | 0.0 | 12.2 | |

Average Kept Catch Size (In CM) SPC KOK Water 55928 Year 2006 Stat Method 1

| | Estimate | | | | |
|---|---|---|---|---|---|
| STRATA | BANK | BOAT | OTHER | ALL | |
| MARWD | 0 | 0 | 0 | 0 | |
| MARWE | 0 | 0 | 0 | 0 | |
| APRWE | 0 | 0 | 0 | 0 | |
| APRWD | 0 | 0 | 0 | 0 | |
| MAYWD | 29.21 | 0 | 0 | 29.21 | |
| MAYWE | 0 | 0 | 0 | 0 | |
| JUNWD | 0 | 0 | 0 | 0 | |
| JUNWE | 0 | 33.02 | 0 | 33.02 | |
| JULWE | 0 | 0 | 0 | 0 | |
| JULWD | 0 | 0 | 0 | 0 | |
| AUGWD | 0 | 0 | 0 | 0 | |
| AUGWE | 35.56 | 0 | 0 | 35.56 | |
| ALL | 30.23 | 33.02 | 0 | 30.99 | |

Average Completed Trip Length Water 55928 Year 2006 Stat Method

| | Estimate | | | |
|---|---|---|---|---|
| STRATA | BANK | BOAT | OTHER | ALL |
| MARWD | 2.4 | 0.0 | 0.0 | 2.4 |
| MARWE | 2.5 | 0.0 | 0.0 | 2.5 |
| APRWE | 2.7 | 0.0 | 0.0 | 2.7 |
| APRWD | 2.2 | 2.0 | 5.0 | 2.4 |
| MAYWD | 2.5 | 3.6 | 4.0 | 2.9 |
| MAYWE | 3.7 | 5.4 | 3.0 | 4.1 |
| JUNWD | 2.8 | 3.4 | 0.0 | 3.0 |
| JUNWE | 3.3 | 4.4 | 4.5 | 3.5 |
| JULWE | 4.2 | 2.2 | 0.0 | 3.9 |
| JULWD | 3.0 | 4.1 | 0.0 | 3.2 |
| AUGWD | 2.9 | 4.0 | 7.0 | 3.3 |
| AUGWE | 3.5 | 3.8 | 0.0 | 3.6 |
| ALL | 3.1 | 3.9 | 4.3 | 3.3 |

SUMMARY SPC KOK Water 55928 Year 2006 Stat Method 1

| | Estimate | | | | Std Error | | | |
|---|---|---|---|---|---|---|---|---|
| REPORT | BANK | BOAT | OTHER | ALL | BANK | BOAT | OTHER | ALL |
| Total Catch | 18.7 | 6.7 | 0.0 | 25.4 | 16.2 | 6.7 | 0.0 | 17.6 |
| Total Catch/hour | 0.001 | 0.001 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 |
| Kept catch | 18.7 | 6.7 | 0.0 | 25.4 | 16.2 | 6.7 | 0.0 | 17.6 |
| Kept Catch/hour | 0.001 | 0.001 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 |
| Returned Catch | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Returned Catch/hour | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Average Kept Catch Size (INCH) | 11.9 | 13.0 | 0.0 | 12.2 | | | | |
| Average Kept Catch Size (CM) | 30.11 | 33.02 | 0 | 30.88 | | | | |
| Average Trip Length | 3.1 | 3.9 | 4.3 | 3.3 | | | | |

TOTAL CATCH SPC LOC Water 55928 Year 2006 Stat Method 1

| | Estimate | | | | Std Error | | | |
|---|---|---|---|---|---|---|---|---|
| STRATA | BANK | BOAT | OTHER | ALL | BANK | BOAT | OTHER | ALL |
| MARWD | 5.2 | 0.0 | 0.0 | 5.2 | 5.2 | 0.0 | 0.0 | 5.2 |
| MARWE | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| APRWE | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| APRWD | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| MAYWD | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| MAYWE | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| JUNWD | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| JUNWE | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| JULWE | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| JULWD | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| AUGWD | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| AUGWE | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| ALL | 5.2 | 0.0 | 0.0 | 5.2 | 5.2 | 0.0 | 0.0 | 5.2 |
| TOTAL CONTACTS: | BANK = 775.0 | BOAT = 74.0 | OTHER =11.0 | ALL = 860.0 | | | | |
| TOTAL HOURS: | BANK = 4771.5 | BOAT = 569.0 | OTHER =68.3 | ALL = 5408.8 | | | | |

TOTAL CATCH/HR SPC LOC Water 55928 Year 2006 Stat Method 1

| | Estimate | | | | Std Error | | | |
|---|---|---|---|---|---|---|---|---|
| STRATA | BANK | BOAT | OTHER | ALL | BANK | BOAT | OTHER | ALL |
| MARWD | 0.007 | 0.000 | 0.000 | 0.007 | 0.000 | 0.000 | 0.000 | 0.000 |
| MARWE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| APRWE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| APRWD | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| MAYWD | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| MAYWE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| JUNWD | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| JUNWE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| JULWE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| JULWD | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| AUGWD | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| AUGWE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| ALL | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |

CREEL CATCH SPC LOC Water 55928 Year 2006 Stat Method 1

| | Estimate | | | | Std Error | | | |
|---|---|---|---|---|---|---|---|---|
| STRATA | BANK | BOAT | OTHER | ALL | BANK | BOAT | OTHER | ALL |
| MARWD | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| MARWE | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| APRWE | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| APRWD | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| MAYWD | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| MAYWE | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| JUNWD | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| JUNWE | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| JULWE | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| JULWD | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| AUGWD | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| AUGWE | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| ALL | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |

CREEL CATCH/HR SPC LOC Water 55928 Year 2006 Stat Method 1

| | Estimate | | | | Std Error | | | |
|---|---|---|---|---|---|---|---|---|
| STRATA | BANK | BOAT | OTHER | ALL | BANK | BOAT | OTHER | ALL |
| MARWD | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| MARWE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| APRWE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| APRWD | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| MAYWD | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| MAYWE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| JUNWD | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| JUNWE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| JULWE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| JULWD | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| AUGWD | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| AUGWE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| ALL | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |

RETURNED CATCH SPC LOC Water 55928 Year 2006 Stat Method 1

| | Estimate | | | | Std Error | | | |
|---|---|---|---|---|---|---|---|---|
| STRATA | BANK | BOAT | OTHER | ALL | BANK | BOAT | OTHER | ALL |
| MARWD | 5.2 | 0.0 | 0.0 | 5.2 | 5.2 | 0.0 | 0.0 | 5.2 |
| MARWE | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| APRWE | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| APRWD | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| MAYWD | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| MAYWE | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| JUNWD | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| JUNWE | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| JULWE | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| JULWD | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| AUGWD | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| AUGWE | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| ALL | 5.2 | 0.0 | 0.0 | 5.2 | 5.2 | 0.0 | 0.0 | 5.2 |

RETURNED CATCH/HR SPC LOC Water 55928 Year 2006 Stat Method 1

| | Estimate | | | | Std Error | | | |
|---|---|---|---|---|---|---|---|---|
| STRATA | BANK | BOAT | OTHER | ALL | BANK | BOAT | OTHER | ALL |
| MARWD | 0.007 | 0.000 | 0.000 | 0.007 | 0.000 | 0.000 | 0.000 | 0.000 |
| MARWE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| APRWE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| APRWD | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| MAYWD | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| MAYWE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| JUNWD | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| JUNWE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| JULWE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| JULWD | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| AUGWD | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| AUGWE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| ALL | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |

Average Kept Catch Size (In INCH) SPC LOC Water 55928 Year 2006 Stat Method 1

| | Estimate | | | | |
|---|---|---|---|---|---|
| STRATA | BANK | BOAT | OTHER | ALL | |
| MARWD | 0.0 | 0.0 | 0.0 | 0.0 | |
| MARWE | 0.0 | 0.0 | 0.0 | 0.0 | |
| APRWE | 0.0 | 0.0 | 0.0 | 0.0 | |
| APRWD | 0.0 | 0.0 | 0.0 | 0.0 | |
| MAYWD | 0.0 | 0.0 | 0.0 | 0.0 | |
| MAYWE | 0.0 | 0.0 | 0.0 | 0.0 | |
| JUNWD | 0.0 | 0.0 | 0.0 | 0.0 | |
| JUNWE | 0.0 | 0.0 | 0.0 | 0.0 | |
| JULWE | 0.0 | 0.0 | 0.0 | 0.0 | |
| JULWD | 0.0 | 0.0 | 0.0 | 0.0 | |
| AUGWD | 0.0 | 0.0 | 0.0 | 0.0 | |
| AUGWE | 0.0 | 0.0 | 0.0 | 0.0 | |
| ALL | 0.0 | 0.0 | 0.0 | 0.0 | |

Average Kept Catch Size (In CM) SPC LOC Water 55928 Year 2006 Stat Method 1

| | Estimate | | | |
|---|---|---|---|---|
| STRATA | BANK | BOAT | OTHER | ALL |
| MARWD | 0 | 0 | 0 | 0 |
| MARWE | 0 | 0 | 0 | 0 |
| APRWE | 0 | 0 | 0 | 0 |
| APRWD | 0 | 0 | 0 | 0 |
| MAYWD | 0 | 0 | 0 | 0 |
| MAYWE | 0 | 0 | 0 | 0 |
| JUNWD | 0 | 0 | 0 | 0 |
| JUNWE | 0 | 0 | 0 | 0 |
| JULWE | 0 | 0 | 0 | 0 |
| JULWD | 0 | 0 | 0 | 0 |
| AUGWD | 0 | 0 | 0 | 0 |
| AUGWE | 0 | 0 | 0 | 0 |
| ALL | 0 | 0 | 0 | 0 |

Average Completed Trip Length Water 55928 Year 2006 Stat Method

| | Estimate | | | |
|---|---|---|---|---|
| STRATA | BANK | BOAT | OTHER | ALL |
| MARWD | 2.4 | 0.0 | 0.0 | 2.4 |
| MARWE | 2.5 | 0.0 | 0.0 | 2.5 |
| APRWE | 2.7 | 0.0 | 0.0 | 2.7 |
| APRWD | 2.2 | 2.0 | 5.0 | 2.4 |
| MAYWD | 2.5 | 3.6 | 4.0 | 2.9 |
| MAYWE | 3.7 | 5.4 | 3.0 | 4.1 |
| JUNWD | 2.8 | 3.4 | 0.0 | 3.0 |
| JUNWE | 3.3 | 4.4 | 4.5 | 3.5 |
| JULWE | 4.2 | 2.2 | 0.0 | 3.9 |
| JULWD | 3.0 | 4.1 | 0.0 | 3.2 |
| AUGWD | 2.9 | 4.0 | 7.0 | 3.3 |
| AUGWE | 3.5 | 3.8 | 0.0 | 3.6 |
| ALL | 3.1 | 3.9 | 4.3 | 3.3 |

SUMMARY SPC LOC Water 55928 Year 2006 Stat Method 1

| | Estimate | | | | Std Error | | | |
|---|---|---|---|---|---|---|---|---|
| REPORT | BANK | BOAT | OTHER | ALL | BANK | BOAT | OTHER | ALL |
| Total Catch | 5.2 | 0.0 | 0.0 | 5.2 | 5.2 | 0.0 | 0.0 | 5.2 |
| Total Catch/hour | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Kept catch | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Kept Catch/hour | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Returned Catch | 5.2 | 0.0 | 0.0 | 5.2 | 5.2 | 0.0 | 0.0 | 5.2 |
| Returned Catch/hour | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Average Kept Catch Size (INCH) | 0.0 | 0.0 | 0.0 | 0.0 | | | | |
| Average Kept Catch Size (CM) | 0 | 0 | 0 | 0 | | | | |
| Average Trip Length | 3.1 | 3.9 | 4.3 | 3.3 | | | | |

TOTAL CATCH SPC MAC Water 55928 Year 2006 Stat Method 1

| | Estimate | | | | Std Error | | | |
|---|---|---|---|---|---|---|---|---|
| STRATA | BANK | BOAT | OTHER | ALL | BANK | BOAT | OTHER | ALL |
| MARWD | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| MARWE | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| APRWE | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| APRWD | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| MAYWD | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| MAYWE | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| JUNWD | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| JUNWE | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| JULWE | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| JULWD | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| AUGWD | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| AUGWE | 0.0 | 5.9 | 0.0 | 5.9 | 0.0 | 5.9 | 0.0 | 5.9 |
| ALL | 0.0 | 5.9 | 0.0 | 5.9 | 0.0 | 5.9 | 0.0 | 5.9 |
| TOTAL CONTACTS: | BANK = 775.0 | | BOAT = 74.0 | | OTHER =11.0 | ALL = 860.0 | | |
| TOTAL HOURS: | BANK = 4771.5 | | BOAT = 569.0 | | OTHER =68.3 | ALL = 5408.8 | | |

TOTAL CATCH/HR SPC MAC Water 55928 Year 2006 Stat Method 1

| | Estimate | | | | Std Error | | | |
|---|---|---|---|---|---|---|---|---|
| STRATA | BANK | BOAT | OTHER | ALL | BANK | BOAT | OTHER | ALL |
| MARWD | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| MARWE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| APRWE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| APRWD | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| MAYWD | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| MAYWE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| JUNWD | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| JUNWE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| JULWE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| JULWD | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| AUGWD | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| AUGWE | 0.000 | 0.009 | 0.000 | 0.003 | 0.000 | 0.000 | 0.000 | 0.000 |
| ALL | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |

CREEL CATCH SPC MAC Water 55928 Year 2006 Stat Method 1

| | Estimate | | | | Std Error | | | |
|---|---|---|---|---|---|---|---|---|
| STRATA | BANK | BOAT | OTHER | ALL | BANK | BOAT | OTHER | ALL |
| MARWD | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| MARWE | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| APRWE | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| APRWD | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| MAYWD | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| MAYWE | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| JUNWD | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| JUNWE | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| JULWE | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| JULWD | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| AUGWD | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| AUGWE | 0.0 | 5.9 | 0.0 | 5.9 | 0.0 | 5.9 | 0.0 | 5.9 |
| ALL | 0.0 | 5.9 | 0.0 | 5.9 | 0.0 | 5.9 | 0.0 | 5.9 |

CREEL CATCH/HR SPC MAC Water 55928 Year 2006 Stat Method 1

| | Estimate | | | | Std Error | | | |
|---|---|---|---|---|---|---|---|---|
| STRATA | BANK | BOAT | OTHER | ALL | BANK | BOAT | OTHER | ALL |
| MARWD | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| MARWE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| APRWE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| APRWD | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| MAYWD | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| MAYWE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| JUNWD | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| JUNWE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| JULWE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| JULWD | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| AUGWD | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| AUGWE | 0.000 | 0.009 | 0.000 | 0.003 | 0.000 | 0.000 | 0.000 | 0.000 |
| ALL | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |

RETURNED CATCH SPC MAC Water 55928 Year 2006 Stat Method 1

| | Estimate | | | | Std Error | | | |
|---|---|---|---|---|---|---|---|---|
| STRATA | BANK | BOAT | OTHER | ALL | BANK | BOAT | OTHER | ALL |
| MARWD | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| MARWE | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| APRWE | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| APRWD | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| MAYWD | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| MAYWE | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| JUNWD | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| JUNWE | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| JULWE | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| JULWD | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| AUGWD | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| AUGWE | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| ALL | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |

RETURNED CATCH/HR SPC MAC Water 55928 Year 2006 Stat Method 1

| | Estimate | | | | Std Error | | | |
|---|---|---|---|---|---|---|---|---|
| STRATA | BANK | BOAT | OTHER | ALL | BANK | BOAT | OTHER | ALL |
| MARWD | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| MARWE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| APRWE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| APRWD | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| MAYWD | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| MAYWE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| JUNWD | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| JUNWE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| JULWE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| JULWD | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| AUGWD | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| AUGWE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| ALL | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |

Average Kept Catch Size (In INCH) SPC MAC Water 55928 Year 2006 Stat Method 1

| | | Estimate | | | |
|---|---|---|---|---|---|
| STRATA | BANK | BOAT | OTHER | ALL | |
| MARWD | 0.0 | 0.0 | 0.0 | 0.0 | |
| MARWE | 0.0 | 0.0 | 0.0 | 0.0 | |
| APRWE | 0.0 | 0.0 | 0.0 | 0.0 | |
| APRWD | 0.0 | 0.0 | 0.0 | 0.0 | |
| MAYWD | 0.0 | 0.0 | 0.0 | 0.0 | |
| MAYWE | 0.0 | 0.0 | 0.0 | 0.0 | |
| JUNWD | 0.0 | 0.0 | 0.0 | 0.0 | |
| JUNWE | 0.0 | 0.0 | 0.0 | 0.0 | |
| JULWE | 0.0 | 0.0 | 0.0 | 0.0 | |
| JULWD | 0.0 | 0.0 | 0.0 | 0.0 | |
| AUGWD | 0.0 | 0.0 | 0.0 | 0.0 | |
| AUGWE | 0.0 | 14.0 | 0.0 | 14.0 | |
| ALL | 0.0 | 14.0 | 0.0 | 14.0 | |

Average Kept Catch Size (In CM) SPC MAC Water 55928 Year 2006 Stat Method 1

| | | Estimate | | | |
|---|---|---|---|---|---|
| STRATA | BANK | BOAT | OTHER | ALL | |
| MARWD | 0 | 0 | 0 | 0 | |
| MARWE | 0 | 0 | 0 | 0 | |
| APRWE | 0 | 0 | 0 | 0 | |
| APRWD | 0 | 0 | 0 | 0 | |
| MAYWD | 0 | 0 | 0 | 0 | |
| MAYWE | 0 | 0 | 0 | 0 | |
| JUNWD | 0 | 0 | 0 | 0 | |
| JUNWE | 0 | 0 | 0 | 0 | |
| JULWE | 0 | 0 | 0 | 0 | |
| JULWD | 0 | 0 | 0 | 0 | |
| AUGWD | 0 | 0 | 0 | 0 | |
| AUGWE | 0 | 35.56 | 0 | 35.56 | |
| ALL | 0 | 35.56 | 0 | 35.56 | |

Average Completed Trip Length Water 55928 Year 2006 Stat Method

| | | Estimate | | | |
|---|---|---|---|---|---|
| STRATA | BANK | BOAT | OTHER | ALL | |
| MARWD | 2.4 | 0.0 | 0.0 | 2.4 | |
| MARWE | 2.5 | 0.0 | 0.0 | 2.5 | |
| APRWE | 2.7 | 0.0 | 0.0 | 2.7 | |
| APRWD | 2.2 | 2.0 | 5.0 | 2.4 | |
| MAYWD | 2.5 | 3.6 | 4.0 | 2.9 | |
| MAYWE | 3.7 | 5.4 | 3.0 | 4.1 | |
| JUNWD | 2.8 | 3.4 | 0.0 | 3.0 | |
| JUNWE | 3.3 | 4.4 | 4.5 | 3.5 | |
| JULWE | 4.2 | 2.2 | 0.0 | 3.9 | |
| JULWD | 3.0 | 4.1 | 0.0 | 3.2 | |
| AUGWD | 2.9 | 4.0 | 7.0 | 3.3 | |
| AUGWE | 3.5 | 3.8 | 0.0 | 3.6 | |
| ALL | 3.1 | 3.9 | 4.3 | 3.3 | |

SUMMARY SPC MAC Water 55928 Year 2006 Stat Method 1

| | Estimate | | | | Std Error | | | |
|---|---|---|---|---|---|---|---|---|
| REPORT | BANK | BOAT | OTHER | ALL | BANK | BOAT | OTHER | ALL |
| Total Catch | 0.0 | 5.9 | 0.0 | 5.9 | 0.0 | 5.9 | 0.0 | 5.9 |
| Total Catch/hour | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Kept catch | 0.0 | 5.9 | 0.0 | 5.9 | 0.0 | 5.9 | 0.0 | 5.9 |
| Kept Catch/hour | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Returned Catch | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Returned Catch/hour | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Average Kept Catch Size (INCH) | 0.0 | 14.0 | 0.0 | 14.0 | | | | |
| Average Kept Catch Size (CM) | 0 | 35.56 | 0 | 35.56 | | | | |
| Average Trip Length | 3.1 | 3.9 | 4.3 | 3.3 | | | | |

TOTAL CATCH SPC RBT Water 55928 Year 2006 Stat Method 1

| | Estimate | | | | Std Error | | | |
|---|---|---|---|---|---|---|---|---|
| STRATA | BANK | BOAT | OTHER | ALL | BANK | BOAT | OTHER | ALL |
| MARWD | 358.4 | 0.0 | 0.0 | 358.4 | 217.3 | 0.0 | 0.0 | 217.3 |
| MARWE | 26.7 | 0.0 | 0.0 | 26.7 | 9.8 | 0.0 | 0.0 | 9.8 |
| APRWE | 337.5 | 0.0 | 0.0 | 337.5 | 114.2 | 0.0 | 0.0 | 114.2 |
| APRWD | 380.8 | 0.0 | 0.0 | 380.8 | 186.1 | 0.0 | 0.0 | 186.1 |
| MAYWD | 1403.5 | 160.4 | 1.2 | 1565.2 | 351.0 | 133.8 | 1.2 | 435.4 |
| MAYWE | 1215.7 | 122.5 | 0.0 | 1338.2 | 299.8 | 40.5 | 0.0 | 302.5 |
| JUNWD | 877.5 | 380.1 | 0.0 | 1257.6 | 235.0 | 177.7 | 0.0 | 520.3 |
| JUNWE | 584.9 | 116.8 | 107.3 | 809.0 | 108.5 | 43.1 | 36.3 | 218.2 |
| JULWE | 287.2 | 16.0 | 0.0 | 303.2 | 61.6 | 9.8 | 0.0 | 69.2 |
| JULWD | 161.6 | 0.0 | 0.0 | 161.6 | 44.1 | 0.0 | 0.0 | 44.1 |
| AUGWD | 325.4 | 54.6 | 0.0 | 380.0 | 148.9 | 31.0 | 0.0 | 170.4 |
| AUGWE | 196.0 | 101.2 | 0.0 | 297.2 | 62.8 | 65.6 | 0.0 | 116.1 |
| ALL | 6155.3 | 951.6 | 108.6 | 7215.5 | 637.9 | 241.5 | 36.3 | 862.4 |
| TOTAL CONTACTS: | BANK = 775.0 | BOAT = 74.0 | | | OTHER =11.0 | ALL = 860.0 | | |
| TOTAL HOURS: | BANK = 4771.5 | BOAT = 569.0 | | | OTHER =68.3 | ALL = 5408.8 | | |

TOTAL CATCH/HR SPC RBT Water 55928 Year 2006 Stat Method 1

| | Estimate | | | | Std Error | | | |
|---|---|---|---|---|---|---|---|---|
| STRATA | BANK | BOAT | OTHER | ALL | BANK | BOAT | OTHER | ALL |
| MARWD | 0.452 | 0.000 | 0.000 | 0.452 | 0.086 | 0.000 | 0.000 | 0.086 |
| MARWE | 0.058 | 0.000 | 0.000 | 0.058 | 0.017 | 0.000 | 0.000 | 0.017 |
| APRWE | 0.325 | 0.000 | 0.000 | 0.285 | 0.044 | 0.000 | 0.000 | 0.030 |
| APRWD | 0.582 | 0.000 | 0.000 | 0.508 | 0.209 | 0.000 | 0.000 | 0.178 |
| MAYWD | 0.587 | 0.360 | 0.014 | 0.535 | 0.165 | 0.161 | 0.016 | 0.113 |
| MAYWE | 0.367 | 0.362 | 0.000 | 0.358 | 0.080 | 0.121 | 0.000 | 0.357 |
| JUNWD | 0.412 | 0.585 | 0.000 | 0.443 | 0.104 | 0.207 | 0.000 | 0.172 |
| JUNWE | 0.192 | 0.177 | 0.511 | 0.206 | 0.021 | 0.056 | 0.227 | 0.048 |
| JULWE | 0.145 | 0.026 | 0.000 | 0.112 | 0.028 | 0.016 | 0.000 | 0.024 |
| JULWD | 0.119 | 0.000 | 0.000 | 0.091 | 0.032 | 0.000 | 0.000 | 0.022 |
| AUGWD | 0.195 | 0.079 | 0.000 | 0.153 | 0.059 | 0.053 | 0.000 | 0.054 |
| AUGWE | 0.134 | 0.157 | 0.000 | 0.135 | 0.033 | 0.117 | 0.000 | 0.052 |
| ALL | 0.303 | 0.205 | 0.127 | 0.280 | 0.017 | 0.045 | 0.045 | 0.055 |

CREEL CATCH SPC RBT Water 55928 Year 2006 Stat Method 1

| | Estimate | | | | Std Error | | | |
|---|---|---|---|---|---|---|---|---|
| STRATA | BANK | BOAT | OTHER | ALL | BANK | BOAT | OTHER | ALL |
| MARWD | 89.1 | 0.0 | 0.0 | 89.1 | 36.7 | 0.0 | 0.0 | 36.7 |
| MARWE | 7.7 | 0.0 | 0.0 | 7.7 | 4.6 | 0.0 | 0.0 | 4.6 |
| APRWE | 255.1 | 0.0 | 0.0 | 255.1 | 112.7 | 0.0 | 0.0 | 112.7 |
| APRWD | 174.3 | 0.0 | 0.0 | 174.3 | 62.5 | 0.0 | 0.0 | 62.5 |
| MAYWD | 1203.9 | 160.4 | 1.2 | 1365.5 | 314.5 | 133.8 | 1.2 | 406.6 |
| MAYWE | 1175.2 | 122.5 | 0.0 | 1297.7 | 299.2 | 40.5 | 0.0 | 301.9 |
| JUNWD | 877.5 | 380.1 | 0.0 | 1257.6 | 235.0 | 177.7 | 0.0 | 520.3 |
| JUNWE | 551.1 | 114.3 | 107.3 | 772.7 | 108.5 | 43.0 | 36.3 | 215.2 |
| JULWE | 285.1 | 16.0 | 0.0 | 301.0 | 62.1 | 9.8 | 0.0 | 69.7 |
| JULWD | 156.7 | 0.0 | 0.0 | 156.7 | 44.8 | 0.0 | 0.0 | 44.8 |
| AUGWD | 308.4 | 54.6 | 0.0 | 363.0 | 141.2 | 31.0 | 0.0 | 161.0 |
| AUGWE | 181.4 | 83.4 | 0.0 | 264.8 | 56.5 | 53.6 | 0.0 | 98.1 |
| ALL | 5265.4 | 931.3 | 108.6 | 6305.2 | 549.9 | 238.5 | 36.3 | 796.2 |

CREEL CATCH/HR SPC RBT Water 55928 Year 2006 Stat Method 1

| | Estimate | | | | Std Error | | | |
|---|---|---|---|---|---|---|---|---|
| STRATA | BANK | BOAT | OTHER | ALL | BANK | BOAT | OTHER | ALL |
| MARWD | 0.112 | 0.000 | 0.000 | 0.112 | 0.067 | 0.000 | 0.000 | 0.067 |
| MARWE | 0.017 | 0.000 | 0.000 | 0.017 | 0.015 | 0.000 | 0.000 | 0.015 |
| APRWE | 0.246 | 0.000 | 0.000 | 0.215 | 0.074 | 0.000 | 0.000 | 0.056 |
| APRWD | 0.267 | 0.000 | 0.000 | 0.232 | 0.075 | 0.000 | 0.000 | 0.068 |
| MAYWD | 0.503 | 0.360 | 0.014 | 0.467 | 0.125 | 0.161 | 0.016 | 0.084 |
| MAYWE | 0.355 | 0.362 | 0.000 | 0.348 | 0.078 | 0.121 | 0.000 | 0.345 |
| JUNWD | 0.412 | 0.585 | 0.000 | 0.443 | 0.104 | 0.207 | 0.000 | 0.172 |
| JUNWE | 0.181 | 0.173 | 0.511 | 0.197 | 0.017 | 0.055 | 0.227 | 0.045 |
| JULWE | 0.144 | 0.026 | 0.000 | 0.111 | 0.028 | 0.016 | 0.000 | 0.024 |
| JULWD | 0.115 | 0.000 | 0.000 | 0.088 | 0.033 | 0.000 | 0.000 | 0.023 |
| AUGWD | 0.185 | 0.079 | 0.000 | 0.146 | 0.060 | 0.053 | 0.000 | 0.052 |
| AUGWE | 0.124 | 0.129 | 0.000 | 0.120 | 0.029 | 0.095 | 0.000 | 0.043 |
| ALL | 0.259 | 0.201 | 0.127 | 0.244 | 0.016 | 0.044 | 0.045 | 0.054 |

RETURNED CATCH SPC RBT Water 55928 Year 2006 Stat Method 1

| | Estimate | | | | Std Error | | | |
|---|---|---|---|---|---|---|---|---|
| STRATA | BANK | BOAT | OTHER | ALL | BANK | BOAT | OTHER | ALL |
| MARWD | 269.4 | 0.0 | 0.0 | 269.4 | 203.4 | 0.0 | 0.0 | 203.4 |
| MARWE | 19.0 | 0.0 | 0.0 | 19.0 | 9.5 | 0.0 | 0.0 | 9.5 |
| APRWE | 82.4 | 0.0 | 0.0 | 82.4 | 42.1 | 0.0 | 0.0 | 42.1 |
| APRWD | 206.4 | 0.0 | 0.0 | 206.4 | 143.6 | 0.0 | 0.0 | 143.6 |
| MAYWD | 199.6 | 0.0 | 0.0 | 199.6 | 99.0 | 0.0 | 0.0 | 99.0 |
| MAYWE | 40.5 | 0.0 | 0.0 | 40.5 | 19.9 | 0.0 | 0.0 | 19.9 |
| JUNWD | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| JUNWE | 33.8 | 2.5 | 0.0 | 36.3 | 33.8 | 2.5 | 0.0 | 36.3 |
| JULWE | 2.2 | 0.0 | 0.0 | 2.2 | 2.2 | 0.0 | 0.0 | 2.2 |
| JULWD | 5.0 | 0.0 | 0.0 | 5.0 | 5.0 | 0.0 | 0.0 | 5.0 |
| AUGWD | 17.0 | 0.0 | 0.0 | 17.0 | 17.0 | 0.0 | 0.0 | 17.0 |
| AUGWE | 14.6 | 17.9 | 0.0 | 32.5 | 9.6 | 12.2 | 0.0 | 19.7 |
| ALL | 889.9 | 20.4 | 0.0 | 910.2 | 274.9 | 12.5 | 0.0 | 275.8 |

RETURNED CATCH/HR SPC RBT Water 55928 Year 2006 Stat Method 1

| | Estimate | | | | Std Error | | | |
|---|---|---|---|---|---|---|---|---|
| STRATA | BANK | BOAT | OTHER | ALL | BANK | BOAT | OTHER | ALL |
| MARWD | 0.340 | 0.000 | 0.000 | 0.340 | 0.089 | 0.000 | 0.000 | 0.089 |
| MARWE | 0.042 | 0.000 | 0.000 | 0.042 | 0.000 | 0.000 | 0.000 | 0.000 |
| APRWE | 0.079 | 0.000 | 0.000 | 0.070 | 0.035 | 0.000 | 0.000 | 0.033 |
| APRWD | 0.316 | 0.000 | 0.000 | 0.275 | 0.179 | 0.000 | 0.000 | 0.153 |
| MAYWD | 0.083 | 0.000 | 0.000 | 0.068 | 0.053 | 0.000 | 0.000 | 0.042 |
| MAYWE | 0.012 | 0.000 | 0.000 | 0.011 | 0.000 | 0.000 | 0.000 | 0.011 |
| JUNWD | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| JUNWE | 0.011 | 0.004 | 0.000 | 0.009 | 0.012 | 0.000 | 0.000 | 0.000 |
| JULWE | 0.001 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 |
| JULWD | 0.004 | 0.000 | 0.000 | 0.003 | 0.000 | 0.000 | 0.000 | 0.000 |
| AUGWD | 0.010 | 0.000 | 0.000 | 0.007 | 0.000 | 0.000 | 0.000 | 0.000 |
| AUGWE | 0.010 | 0.028 | 0.000 | 0.015 | 0.000 | 0.022 | 0.000 | 0.000 |
| ALL | 0.044 | 0.004 | 0.000 | 0.035 | 0.013 | 0.000 | 0.000 | 0.010 |

Average Kept Catch Size (In INCH) SPC RBT Water 55928 Year 2006 Stat Method 1

| | Estimate | | | | |
|---|---|---|---|---|---|
| STRATA | BANK | BOAT | OTHER | ALL | |
| MARWD | 12.7 | 0.0 | 0.0 | 12.7 | |
| MARWE | 9.6 | 0.0 | 0.0 | 9.6 | |
| APRWE | 11.4 | 0.0 | 0.0 | 11.4 | |
| APRWD | 12.4 | 0.0 | 0.0 | 12.4 | |
| MAYWD | 12.5 | 12.5 | 12.3 | 12.5 | |
| MAYWE | 11.9 | 12.9 | 0.0 | 12.0 | |
| JUNWD | 11.9 | 13.1 | 0.0 | 12.3 | |
| JUNWE | 12.1 | 13.2 | 13.1 | 12.4 | |
| JULWE | 12.9 | 12.5 | 0.0 | 12.9 | |
| JULWD | 12.4 | 0.0 | 0.0 | 12.4 | |
| AUGWD | 12.3 | 13.4 | 0.0 | 12.5 | |
| AUGWE | 11.3 | 11.3 | 0.0 | 11.3 | |
| ALL | 12.1 | 12.9 | 13.1 | 12.3 | |

Average Kept Catch Size (In CM) SPC RBT Water 55928 Year 2006 Stat Method 1

| | Estimate | | | | |
|---|---|---|---|---|---|
| STRATA | BANK | BOAT | OTHER | ALL | |
| MARWD | 32.2 | 0 | 0 | 32.2 | |
| MARWE | 24.37 | 0 | 0 | 24.37 | |
| APRWE | 28.98 | 0 | 0 | 28.98 | |
| APRWD | 31.41 | 0 | 0 | 31.41 | |
| MAYWD | 31.85 | 31.88 | 31.12 | 31.85 | |
| MAYWE | 30.3 | 32.69 | 0 | 30.52 | |
| JUNWD | 30.16 | 33.34 | 0 | 31.12 | |
| JUNWE | 30.76 | 33.61 | 33.17 | 31.52 | |
| JULWE | 32.8 | 31.86 | 0 | 32.75 | |
| JULWD | 31.39 | 0 | 0 | 31.39 | |
| AUGWD | 31.29 | 34.1 | 0 | 31.71 | |
| AUGWE | 28.64 | 28.79 | 0 | 28.69 | |
| ALL | 30.73 | 32.77 | 33.27 | 31.24 | |

Average Completed Trip Length Water 55928 Year 2006 Stat Method

| | Estimate | | | | |
|---|---|---|---|---|---|
| STRATA | BANK | BOAT | OTHER | ALL | |
| MARWD | 2.4 | 0.0 | 0.0 | 2.4 | |
| MARWE | 2.5 | 0.0 | 0.0 | 2.5 | |
| APRWE | 2.7 | 0.0 | 0.0 | 2.7 | |
| APRWD | 2.2 | 2.0 | 5.0 | 2.4 | |
| MAYWD | 2.5 | 3.6 | 4.0 | 2.9 | |
| MAYWE | 3.7 | 5.4 | 3.0 | 4.1 | |
| JUNWD | 2.8 | 3.4 | 0.0 | 3.0 | |
| JUNWE | 3.3 | 4.4 | 4.5 | 3.5 | |
| JULWE | 4.2 | 2.2 | 0.0 | 3.9 | |
| JULWD | 3.0 | 4.1 | 0.0 | 3.2 | |
| AUGWD | 2.9 | 4.0 | 7.0 | 3.3 | |
| AUGWE | 3.5 | 3.8 | 0.0 | 3.6 | |
| ALL | 3.1 | 3.9 | 4.3 | 3.3 | |

SUMMARY SPC RBT Water 55928 Year 2006 Stat Method 1

| | Estimate | | | | Std Error | | | |
|---|---|---|---|---|---|---|---|---|
| REPORT | BANK | BOAT | OTHER | ALL | BANK | BOAT | OTHER | ALL |
| Total Catch | 6155.3 | 951.6 | 108.6 | 7215.5 | 637.9 | 241.5 | 36.3 | 862.4 |
| Total Catch/hour | 0.303 | 0.205 | 0.127 | 0.280 | 0.017 | 0.045 | 0.045 | 0.055 |
| Kept catch | 5265.4 | 931.3 | 108.6 | 6305.2 | 549.9 | 238.5 | 36.3 | 796.2 |
| Kept Catch/hour | 0.259 | 0.201 | 0.127 | 0.244 | 0.016 | 0.044 | 0.045 | 0.054 |
| Returned Catch | 889.9 | 20.4 | 0.0 | 910.2 | 274.9 | 12.5 | 0.0 | 275.8 |
| Returned Catch/hour | 0.044 | 0.004 | 0.000 | 0.035 | 0.013 | 0.000 | 0.000 | 0.010 |
| Average Kept Catch Size (INCH) | 12.1 | 12.9 | 13.1 | 12.3 | | | | |
| Average Kept Catch Size (CM) | 30.83 | 32.65 | 33.15 | 31.14 | | | | |
| Average Trip Length | 3.1 | 3.9 | 4.3 | 3.3 | | | | |

TOTAL CATCH SPC TGM Water 55928 Year 2006 Stat Method 1

| | Estimate | | | | Std Error | | | |
|---|---|---|---|---|---|---|---|---|
| STRATA | BANK | BOAT | OTHER | ALL | BANK | BOAT | OTHER | ALL |
| MARWD | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| MARWE | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| APRWE | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| APRWD | 6.9 | 0.0 | 0.0 | 6.9 | 6.9 | 0.0 | 0.0 | 6.9 |
| MAYWD | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| MAYWE | 7.6 | 0.0 | 0.0 | 7.6 | 5.2 | 0.0 | 0.0 | 5.2 |
| JUNWD | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| JUNWE | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| JULWE | 13.1 | 26.1 | 0.0 | 39.2 | 13.1 | 26.1 | 0.0 | 39.2 |
| JULWD | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| AUGWD | 3.1 | 0.0 | 0.0 | 3.1 | 3.1 | 0.0 | 0.0 | 3.1 |
| AUGWE | 0.0 | 8.2 | 0.0 | 8.2 | 0.0 | 8.2 | 0.0 | 8.2 |
| ALL | 30.7 | 34.3 | 0.0 | 65.0 | 16.0 | 27.4 | 0.0 | 41.1 |
| TOTAL CONTACTS: | BANK = 775.0 | BOAT = 74.0 | | OTHER =11.0 | ALL = 860.0 | | | |
| TOTAL HOURS: | BANK = 4771.5 | BOAT = 569.0 | | OTHER =68.3 | ALL = 5408.8 | | | |

TOTAL CATCH/HR SPC TGM Water 55928 Year 2006 Stat Method 1

| | Estimate | | | | Std Error | | | |
|---|---|---|---|---|---|---|---|---|
| STRATA | BANK | BOAT | OTHER | ALL | BANK | BOAT | OTHER | ALL |
| MARWD | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| MARWE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| APRWE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| APRWD | 0.011 | 0.000 | 0.000 | 0.009 | 0.011 | 0.000 | 0.000 | 0.000 |
| MAYWD | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| MAYWE | 0.002 | 0.000 | 0.000 | 0.002 | 0.000 | 0.000 | 0.000 | 0.000 |
| JUNWD | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| JUNWE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| JULWE | 0.007 | 0.042 | 0.000 | 0.014 | 0.000 | 0.040 | 0.000 | 0.014 |
| JULWD | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| AUGWD | 0.002 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 |
| AUGWE | 0.000 | 0.013 | 0.000 | 0.004 | 0.000 | 0.013 | 0.000 | 0.000 |
| ALL | 0.002 | 0.007 | 0.000 | 0.003 | 0.000 | 0.000 | 0.000 | 0.000 |

CREEL CATCH SPC TGM Water 55928 Year 2006 Stat Method 1

| | Estimate | | | | Std Error | | | |
|---|---|---|---|---|---|---|---|---|
| STRATA | BANK | BOAT | OTHER | ALL | BANK | BOAT | OTHER | ALL |
| MARWD | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| MARWE | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| APRWE | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| APRWD | 6.9 | 0.0 | 0.0 | 6.9 | 6.9 | 0.0 | 0.0 | 6.9 |
| MAYWD | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| MAYWE | 7.6 | 0.0 | 0.0 | 7.6 | 5.2 | 0.0 | 0.0 | 5.2 |
| JUNWD | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| JUNWE | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| JULWE | 13.1 | 26.1 | 0.0 | 39.2 | 13.1 | 26.1 | 0.0 | 39.2 |
| JULWD | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| AUGWD | 3.1 | 0.0 | 0.0 | 3.1 | 3.1 | 0.0 | 0.0 | 3.1 |
| AUGWE | 0.0 | 8.2 | 0.0 | 8.2 | 0.0 | 8.2 | 0.0 | 8.2 |
| ALL | 30.7 | 34.3 | 0.0 | 65.0 | 16.0 | 27.4 | 0.0 | 41.1 |

CREEL CATCH/HR SPC TGM Water 55928 Year 2006 Stat Method 1

| | Estimate | | | | Std Error | | | |
|---|---|---|---|---|---|---|---|---|
| STRATA | BANK | BOAT | OTHER | ALL | BANK | BOAT | OTHER | ALL |
| MARWD | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| MARWE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| APRWE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| APRWD | 0.011 | 0.000 | 0.000 | 0.009 | 0.011 | 0.000 | 0.000 | 0.000 |
| MAYWD | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| MAYWE | 0.002 | 0.000 | 0.000 | 0.002 | 0.000 | 0.000 | 0.000 | 0.000 |
| JUNWD | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| JUNWE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| JULWE | 0.007 | 0.042 | 0.000 | 0.014 | 0.000 | 0.040 | 0.000 | 0.014 |
| JULWD | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| AUGWD | 0.002 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 |
| AUGWE | 0.000 | 0.013 | 0.000 | 0.004 | 0.000 | 0.013 | 0.000 | 0.000 |
| ALL | 0.002 | 0.007 | 0.000 | 0.003 | 0.000 | 0.000 | 0.000 | 0.000 |

RETURNED CATCH SPC TGM Water 55928 Year 2006 Stat Method 1

| | Estimate | | | | Std Error | | | |
|---|---|---|---|---|---|---|---|---|
| STRATA | BANK | BOAT | OTHER | ALL | BANK | BOAT | OTHER | ALL |
| MARWD | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| MARWE | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| APRWE | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| APRWD | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| MAYWD | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| MAYWE | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| JUNWD | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| JUNWE | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| JULWE | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| JULWD | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| AUGWD | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| AUGWE | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| ALL | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |

RETURNED CATCH/HR SPC TGM Water 55928 Year 2006 Stat Method 1

| | Estimate | | | | Std Error | | | |
|---|---|---|---|---|---|---|---|---|
| STRATA | BANK | BOAT | OTHER | ALL | BANK | BOAT | OTHER | ALL |
| MARWD | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| MARWE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| APRWE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| APRWD | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| MAYWD | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| MAYWE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| JUNWD | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| JUNWE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| JULWE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| JULWD | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| AUGWD | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| AUGWE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| ALL | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |

Average Kept Catch Size (In INCH) SPC TGM Water 55928 Year 2006 Stat Method 1

| | Estimate | | | |
|---|---|---|---|---|
| STRATA | BANK | BOAT | OTHER | ALL |
| MARWD | 0.0 | 0.0 | 0.0 | 0.0 |
| MARWE | 0.0 | 0.0 | 0.0 | 0.0 |
| APRWE | 0.0 | 0.0 | 0.0 | 0.0 |
| APRWD | 48.0 | 0.0 | 0.0 | 48.0 |
| MAYWD | 0.0 | 0.0 | 0.0 | 0.0 |
| MAYWE | 32.7 | 0.0 | 0.0 | 32.7 |
| JUNWD | 0.0 | 0.0 | 0.0 | 0.0 |
| JUNWE | 0.0 | 0.0 | 0.0 | 0.0 |
| JULWE | 17.3 | 12.2 | 0.0 | 13.9 |
| JULWD | 0.0 | 0.0 | 0.0 | 0.0 |
| AUGWD | 37.0 | 0.0 | 0.0 | 37.0 |
| AUGWE | 0.0 | 36.5 | 0.0 | 36.5 |
| ALL | 30.0 | 18.0 | 0.0 | 23.7 |

Average Kept Catch Size (In CM) SPC TGM Water 55928 Year 2006 Stat Method 1

| | Estimate | | | |
|---|---|---|---|---|
| STRATA | BANK | BOAT | OTHER | ALL |
| MARWD | 0 | 0 | 0 | 0 |
| MARWE | 0 | 0 | 0 | 0 |
| APRWE | 0 | 0 | 0 | 0 |
| APRWD | 121.92 | 0 | 0 | 121.92 |
| MAYWD | 0 | 0 | 0 | 0 |
| MAYWE | 83.07 | 0 | 0 | 83.07 |
| JUNWD | 0 | 0 | 0 | 0 |
| JUNWE | 0 | 0 | 0 | 0 |
| JULWE | 43.97 | 30.9 | 0 | 35.28 |
| JULWD | 0 | 0 | 0 | 0 |
| AUGWD | 93.98 | 0 | 0 | 93.98 |
| AUGWE | 0 | 92.71 | 0 | 92.71 |
| ALL | 76.2 | 45.72 | 0 | 60.2 |

Average Completed Trip Length Water 55928 Year 2006 Stat Method

| | Estimate | | | |
|---|---|---|---|---|
| STRATA | BANK | BOAT | OTHER | ALL |
| MARWD | 2.4 | 0.0 | 0.0 | 2.4 |
| MARWE | 2.5 | 0.0 | 0.0 | 2.5 |
| APRWE | 2.7 | 0.0 | 0.0 | 2.7 |
| APRWD | 2.2 | 2.0 | 5.0 | 2.4 |
| MAYWD | 2.5 | 3.6 | 4.0 | 2.9 |
| MAYWE | 3.7 | 5.4 | 3.0 | 4.1 |
| JUNWD | 2.8 | 3.4 | 0.0 | 3.0 |
| JUNWE | 3.3 | 4.4 | 4.5 | 3.5 |
| JULWE | 4.2 | 2.2 | 0.0 | 3.9 |
| JULWD | 3.0 | 4.1 | 0.0 | 3.2 |
| AUGWD | 2.9 | 4.0 | 7.0 | 3.3 |
| AUGWE | 3.5 | 3.8 | 0.0 | 3.6 |
| ALL | 3.1 | 3.9 | 4.3 | 3.3 |

SUMMARY SPC TGM Water 55928 Year 2006 Stat Method 1

| | Estimate | | | | Std Error | | | |
|---|---|---|---|---|---|---|---|---|
| REPORT | BANK | BOAT | OTHER | ALL | BANK | BOAT | OTHER | ALL |
| Total Catch | 30.7 | 34.3 | 0.0 | 65.0 | 16.0 | 27.4 | 0.0 | 41.1 |
| Total Catch/hour | 0.002 | 0.007 | 0.000 | 0.003 | 0.000 | 0.000 | 0.000 | 0.000 |
| Kept catch | 30.7 | 34.3 | 0.0 | 65.0 | 16.0 | 27.4 | 0.0 | 41.1 |
| Kept Catch/hour | 0.002 | 0.007 | 0.000 | 0.003 | 0.000 | 0.000 | 0.000 | 0.000 |
| Returned Catch | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Returned Catch/hour | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Average Kept Catch Size (INCH) | 30.0 | 18.0 | 0.0 | 23.7 | | | | |
| Average Kept Catch Size (CM) | 76.26 | 45.7 | 0 | 60.14 | | | | |
| Average Trip Length | 3.1 | 3.9 | 4.3 | 3.3 | | | | |

# APPENDIX II.

## Molecular Techniques for Identifying Hofer (GR) Strain Rainbow Trout

# CRR vs. GR AFLPs Progress Report

**J. Wood, S. Silvestri, K. Ballare**
**Pisces Molecular**
**June 19, 2007**

The past 12 months have been frustratingly slow for the CRR x GR AFLP work, as well as our technically related cutthroat genetics AFLP work. However, we believe we have been able to make a number of improvements, both technically and analytically, which have increased the accuracy and greatly streamlined AFLP marker analysis.

While simple conceptually, generating and scoring AFLP markers is a complicated, multi-step procedure in the lab, and is therefore extremely demanding of good technique. We have made significant improvements in most of the procedural steps. (1*) Isolation of sample DNA.* We have found that the AFLP procedure gives better results starting with more DNA than recommended in the literature. This is relevant to the CRR x GR work in that larger fin clip samples (~1 $cm^2$) give better results than very small fin clips (<0.25 $cm^2$). Smaller fin clips, with less total DNA, result in overall lower fluorescent signal intensity for all fragments and reduced scoring accuracy (see (3) below). (2) *Generation of AFLP marker fragments*. AFLP fragments are generated by multiple enzymatic reactions: restriction digestion of sample DNA with two restriction enzymes into a large number (>$10^6$) genomic fragments; ligation of double-stranded DNA oligonucleotides to the genomic fragment ends, then two steps of selective PCR amplification of a small subset number of the total number of initial fragments, using a fluorescently tagged primer in the second amplification. All of these reactions involve large numbers of different genomic fragments and finite reaction times; therefore they are all much less than 100% efficient. We have found that even more thorough reaction mixing than is typically done with "ordinary" PCR reactions, results in more reproducible and stronger marker fragment amplification. (3) *Separation, sizing and scoring of marker fragments on DNA sequencer.* Although we are still not completely sure of the cause, we now know to watch for a "shifting" of fragment sizes. For some number of sequencer runs last winter, all the markers fragments were "shifted" – scored by the sequencer software as several base-pairs (bp) larger than they should have been. For example, if samples A and B both should have had a 100 bp fragment, in a shifted run, the fragment in B might be scored as 102 bp in size. Not surprisingly, such shifting causes serious marker scoring errors; in this example, samples A and B would be scored as very different (A = + for 100 bp, - for 102 bp; B= - for 100 bp, + for 102 bp), when they should have been scored as the same (both + for 100 bp). We have now learned to prevent these errors by screening all sequencer runs for evidence of shifting (the same pattern of fragments in two or more samples, but offset from each other by 1-2 bp). Additionally, for many marker fragments, we have been able to widen the fragment calling "window" in the software from 1 bp in width to 2 bp (allowing a slightly broader range of peak sizes to be called one and the same peak). Finally, we also devised a fragment "culling rule": we now score only those fragments with average peak heights (in our reference and unknown samples) of 200 relative fluorescence units (rfu) or higher.

We found that fragments with average peak height less than 200 rfu were frequently not scored correctly. The peak-calling software relies primarily on the occurrence of rfu values above an arbitrary threshold to call peaks/fragments. For peaks with low average peak heights close to the threshold, small variations between samples can result in discrepant scoring. For example, with the threshold set to 50 rfu's (the default value), sample A with a peak having a height of 49 rfu's would be scored as absent, while sample B, with the same peak at a height of 51 rfu's would be scored as present. Culling the fragments scored to eliminate those with average peak heights of 200 or less, eliminated those fragments with the most frequent scoring errors at only a small cost of real data discarded. Our current CRR x GR marker set (used for STRUCTURE program runs, see below) consists of 149 AFLP polymorphic marker fragments.

In addition to optimizing these procedural or mechanical steps, we have also devoted considerable effort to optimizing data analysis. The original thesis we started with in our AFLP work, for both CRR x GR samples, as well as the cutthroat subspecies samples, was that we would be able to identify and score "perfect" markers, either sub-species or strain-specific (i.e. Colorado cutthroat vs. Greenback cutthroat, or CRR vs. GR); this is the same approach taken by most earlier genetics studies using allozymes or specific nuclear markers. However, given the genetic diversity found even closely related rainbow trout, like the CRR and GR strains, as well as the fact that AFLP marker fragments cover the entire genome, unlike allozymes or individual nuclear markers, this no longer seems the correct approach. Discarding everything but perfect markers fails to utilize a large fraction, or potentially all, of the information present in the AFLP fragment profile of a sample. Accordingly, we now score all the AFLP fragments present in an individual sample (subject to the rules above) to generate a AFLP genomic "fingerprint" for the individual which can be compared statistically to the AFLP fingerprints found in other individuals, strains, or subspecies. We are using the same approach for our cutthroat subspecies work. Comfortingly for our change in thinking, recent AFLP work in the literature shows a similar shift from looking for and using perfect diagnostic markers to comparing genomic fingerprints.

One consequence of comparing genomic fingerprints rather than absolute markers is that scoring for the presence of genes/genomic regions from one strain or subspecies in another strain or species (introgression) becomes a statistical calculation providing only probabilities and confidence intervals, rather than an absolute presence or absence, yes or no answer typical with absolute diagnostic markers. However, since a genomic fingerprint samples from a larger number of locations in the genome than one or a small number of nuclear markers, a fingerprint may have greater net sensitivity for detecting low levels of introgression than a very much smaller number of diagnostic nuclear markers.

Initially, most available population genetic computational programs were not able to correctly handle dominant markers like AFLP fragments. However, as AFLP analyses have become more commonplace, a variety of programs specifically adapted to handle AFLP data have become available (GeneMapper, AFLPOP, AFLP-SURV, TFPGA, STRUCTURE) and this has ceased to be an issue. We have used both AFLPOP and STRUCTURE 2.2 to analyze our CRR x GR sample AFLP data.

The data that we used to refine our data analysis techniques is the AFLP marker data for the Fall, 2006 Antero River, Gunnison River and South Fork Rio Grande fin clip samples from George Schisler; these represent sites where CRR x GR (Gunnison and SF Rio Grande) or GR x Harrison Lake (Antero) fish or progeny were stocked and their genetic background identified from either stocking records. Fortuitously, our cutthroat subspecies AFLP work contributed as well to the data analysis refinement by providing very different population structures and unknown samples: Pure, but multiple, genetically diverse, known reference populations for four cutthroat subspecies to compare against unknown populations, versus a comparison of an unknown individual against two, closely related species (CRR and GR), and their deliberate intercrosses.

AFLPOP is a population assignment program for AFLP data, written as an Excel macro, that performs population allocation based on the (log) sum of frequencies/probabilities of a series of markers present or absent in population X and present or absent in individual G. (Duchesne, P., L. Bernatchez., Molecular Ecology Notes 3:380-383, 2002). Additionally, the program can be set to allocate individuals either to either two parental populations, or to F1 or F2 crosses of the parents. Table 1 shows the population assignments for the 2006 samples determined by AFLPOP.

As an alternative to AFLPOP which allocates individuals based on a known or assumed populations, the program STRUCTURE uses a Bayesian statistical approach to determine the presence of population genetic structures in a series of unknown samples, or between assorted previously identified populations (Falush, D., M. Stephens and J.K. Pritchard, Molecular Ecology Notes 1471-8286, 2007). Starting from an arbitrary set of parameters, it uses a Monte Carlo-Markov chain simulation/iteration to determine the number of genetically distinguishable populations in a test group, and the proportion of each individual's genome that is derived from each of the different populations. Not surprisingly for a program starting from an arbitrary point and running large numbers of iterations (>100,000), obtaining meaningful results from STRUCTURE requires careful setting of the model parameters. (Very much time was devoted to this; the parameter set used is detailed in Table 2) Figure 1 and Table 3 show the predicted proportion (admixture) of each individual's genotype derived from either the CRR or GR parental genotype.

Note for the Antero samples both the AFLPOP assignments and STRUCTURE admixture proportions may be less accurate than for either the Gunnison or SF Rio Grande samples because the non-GR parents used in the crosses for fish stocked into Antero were from the Harrison Lake strain of rainbow trout, rather than the CRR strain of rainbows and the only reference populations used in the AFLPOP and STRUCTURE analyses were CRR and GR. Both CRR and Harrison Lake have been identified as polygot strains of rainbow trout with less than straightforward genetic backgrounds, so there is some possibility that markers scored as polymorphic between CRR and GR may not be polymorphic between Harrison Lake and GR. However, given their broad genetic backgrounds, these two strains may still be relatively more similar to each other than to the European domesticated, relatively narrowly bred GR strain. This potential issue can be resolved by including a reference population of pure Harrison Lake samples in future analyses.

Table 4 shows a comparison between the AFLPOP population assignments and the STRUCTURE program admixture q values for the 2006 samples. Note that the AFLPOP assignments were done before final culling of the marker fragment set was completed, therefore the assignments do not, yet, represent an ideal apples-to-apples comparison between the AFLPOP population assignments and the STRUCTURE program admixture q values. However, even with the slightly different marker sets used, the correspondence between the AFLPOP assignments and the STRUCTURE q values seems quite good (green shaded cells). There are relatively few individuals where the q values seem different than might be expected based on the population to which they are assigned by AFLPOP (yellow shaded cells) (with the caveat noted above for the Antero GR x Harrison samples). These apparent discrepancies will be revisited when the AFLPOP assignments are redone with the same maker fragment set as was used for STRUCTURE. Also included in the rightmost column of Table 4 is the genotype ID assigned, if any, by George Schisler based on the stocking history and/or morphological characteristics of the individual fish.

Finally this past year, we also tested a group of unknown samples submitted by George Schisler and Barry Nehring in August 2006; the STRUCTURE admixture proportions are shown in Table 5 and Figure 2.

**Table 1: AFLPOP Ant, Gunn, SFRG assignments**

| Sample | assignment |
|---|---|
| Ant-66949 | HO Backcross |
| Ant-66950 | F2 |
| Ant-66951 | F2 |
| Ant-66952 | F2 |
| Ant-66953 | F2 |
| Ant-66954 | F2 |
| Ant-66955 | HO Backcross |
| Ant-66956 | F2 |
| Ant-66957 | F2 |
| Ant-66958 | F2 |
| Gun-66911 | CRR |
| Gun-66912 | CRR |
| Gun-66913 | CRR |
| Gun-66914 | CRR Backcross |
| Gun-66915 | CRR Backcross |
| Gun-66916 | CRR |
| Gun-66917 | CRR Backcross |
| Gun-66918 | CRR Backcross |
| Gun-66919 | CRR Backcross |
| Gun-66920 | CRR |
| Gun-66921 | CRR |
| Gun-66922 | CRR Backcross |
| Gun-66923 | CRR Backcross |
| Gun-66924 | CRR Backcross |
| Gun-66925 | F1 |
| Gun-66926 | CRR Backcross |
| Gun-66927 | CRR Backcross |
| Gun-66928 | CRR Backcross |
| Gun-66929 | F2 |
| Gun-66930 | CRR |
| Gun-66931 | CRR |
| Gun-66932 | CRR |
| SFRG-66934 | CRR |
| SFRG-66935 | CRR Backcross |
| SFRG-66937 | CRR |
| SFRG-66938 | F2 |
| SFRG-66939 | F1 |
| SFRG-66940 | CRR Backcross |
| SFRG-66941 | CRR Backcross |
| SFRG-66942 | CRR Backcross |
| SFRG-66943 | CRR |
| SFRG-66944 | F2 |
| SFRG-66945 | CRR Backcross |
| SFRG-66946 | CRR Backcross |
| SFRG-66947 | CRR Backcross |
| SFRG-66948 | CRR |

## Table 2: STRUCTURE parameter value file used for CRR x GR analyses

```
#define OUTFILE \\Pdc1\Data\Company\Genotyping data\HO x CRR data\2006 Ant Gunn & SFRG\Ant_Gunn_SFRG - CRRxHO\gb0 correlated priorpop alleles\Results\gb0 correlated priorpop alleles_run_4
#define INFILE \\Pdc1\Data\Company\Genotyping data\HO x CRR data\2006 Ant Gunn & SFRG\Ant_Gunn_SFRG - CRRxHO\project_data
#define NUMINDS 264
#define NUMLOCI 149
#define LABEL 1
#define POPDATA 1
#define POPFLAG 1
#define PHENOTYPE 0
#define MARKERNAMES 0
#define MAPDISTANCES 0
#define ONEROWPERIND 1
#define PHASEINFO 0
#define PHASED 0
#define RECESSIVEALLELES 1
#define EXTRACOLS 1
#define MISSING 9
#define PLOIDY 2
#define MAXPOPS 5
#define BURNIN 1000
#define NUMREPS 5000

#define USEPOPINFO 1
#define GENSBACK 0
#define MIGRPRIOR 0.05

#define NOADMIX 0

#define LINKAGE 0
#define INFERALPHA 1
#define ALPHA 0.01
#define POPALPHAS 1
#define UNIFPRIORALPHA 0
#define ALPHAPRIORA 0.05
#define ALPHAPRIORB 0.0010

#define FREQSCORR 1
#define ONEFST 0
#define FPRIORMEAN 0.01
#define FPRIORSD 0.05

#define INFERLAMBDA 0
#define LAMBDA 1.0
#define COMPUTEPROB 0
#define PFROMPOPFLAGONLY 1
#define ANCESTDIST 0
#define STARTATPOPINFO 0
#define METROFREQ 10

#define UPDATEFREQ 1
```

## Table 3: STRUCTURE Ant, Gunn, SFRG admixture proportions

| | qCRR | qGR |
|---|---|---|
| F1_aca.cag | 0.32 | 0.69 |

| | | |
|---|---|---|
| F1_aca.cag | 0.62 | 0.38 |
| F1_aca.cag | 0.44 | 0.56 |
| F1_aca.cag | 0.95 | 0.06 |
| F1_aca.cag | 0.17 | 0.83 |
| F1_aca.cag | 0.24 | 0.76 |
| F1_aca.cag | 0.96 | 0.04 |
| F1_aca.cag | 0.90 | 0.10 |
| F1_aca.cag | 0.54 | 0.46 |
| F1_aca.cag | 0.72 | 0.28 |
| F1_aca.cag | 0.69 | 0.31 |
| F1_aca.cag | 0.31 | 0.69 |
| F1_aca.cag | 0.06 | 0.94 |
| F1_aca.cag | 0.06 | 0.95 |
| F1_aca.cag | 0.92 | 0.08 |
| F1_aca.cag | 0.66 | 0.34 |
| F1_aca.cag | 0.05 | 0.95 |
| F1_aca.cag | 0.98 | 0.02 |
| F1_aca.cag | 0.96 | 0.04 |
| F2_aca.cag | 0.97 | 0.03 |
| F2_aca.cag | 0.54 | 0.47 |
| F2_aca.cag | 0.83 | 0.18 |
| F2_aca.cag | 0.68 | 0.32 |
| F2_aca.cag | 0.98 | 0.03 |
| F2_aca.cag | 0.85 | 0.15 |
| F2_aca.cag | 0.61 | 0.39 |
| F2_aca.cag | 0.84 | 0.16 |
| F2_aca.cag | 0.97 | 0.03 |
| F2_aca.cag | 0.88 | 0.12 |
| F2_aca.cag | 0.24 | 0.76 |
| F2_aca.cag | 0.66 | 0.34 |
| F2_aca.cag | 0.85 | 0.15 |
| F2_aca.cag | 0.99 | 0.01 |
| F2_aca.cag | 0.18 | 0.82 |
| F2_aca.cag | 0.55 | 0.45 |
| F2_aca.cag | 0.85 | 0.15 |
| F2_aca.cag | 0.99 | 0.01 |
| F2_aca.cag | 0.86 | 0.14 |
| F2_aca.cag | 0.61 | 0.40 |
| Gun-66911 | 0.92 | 0.08 |
| Gun-66912 | 0.96 | 0.04 |
| Gun-66913 | 0.98 | 0.02 |
| Gun-66914 | 0.97 | 0.03 |
| Gun-66915 | 0.83 | 0.18 |
| Gun-66916 | 0.69 | 0.31 |
| Gun-66917 | 0.54 | 0.46 |
| Gun-66918 | 0.51 | 0.49 |
| Gun-66919 | 0.97 | 0.03 |
| Gun-66920 | 0.83 | 0.17 |
| Gun-66921 | 0.86 | 0.14 |

| | | |
|---|---|---|
| Gun-66922 | 0.93 | 0.07 |
| Gun-66923 | 0.95 | 0.05 |
| Gun-66924 | 0.95 | 0.05 |
| Gun-66925 | 0.81 | 0.19 |
| Gun-66926 | 0.90 | 0.10 |
| Gun-66927 | 0.97 | 0.03 |
| Gun-66928 | 0.89 | 0.11 |
| Gun-66929 | 0.71 | 0.29 |
| Gun-66930 | 0.94 | 0.06 |
| Gun-66931 | 0.91 | 0.09 |
| Gun-66932 | 0.81 | 0.19 |
| Ant-66955 | 0.57 | 0.44 |
| Ant-66956 | 0.76 | 0.24 |
| Ant-66957 | 0.15 | 0.85 |
| Ant-66958 | 0.38 | 0.62 |
| Ant-66949 | 0.58 | 0.43 |
| Ant-66950 | 0.37 | 0.63 |
| Ant-66951 | 0.23 | 0.77 |
| Ant-66952 | 0.49 | 0.51 |
| Ant-66953 | 0.92 | 0.09 |
| Ant-66954 | 0.44 | 0.56 |
| SFRG-66933 | 0.97 | 0.03 |
| SFRG-66934 | 0.61 | 0.39 |
| SFRG-66935 | 0.98 | 0.03 |
| SFRG-66937 | 0.77 | 0.23 |
| SFRG-66938 | 0.74 | 0.26 |
| SFRG-66939 | 0.65 | 0.35 |
| SFRG-66940 | 0.92 | 0.08 |
| SFRG-66941 | 0.90 | 0.10 |
| SFRG-66942 | 0.91 | 0.09 |
| SFRG-66943 | 0.46 | 0.55 |
| SFRG-66944 | 0.83 | 0.17 |
| SFRG-66945 | 0.97 | 0.03 |
| SFRG-66946 | 0.97 | 0.03 |
| SFRG-66947 | 0.48 | 0.52 |
| SFRG-66948 | 0.91 | 0.09 |

### Table 4: AFLPOP & STRUCTURE results comparison

| Sample | AFLPOP assignment | STRUCTURE values | | |
|---|---|---|---|---|
| | | qCRR | qGR | ID |
| Ant-66949 | GR Backcross | 0.58 | 0.43 | 50:50 or 75:25 GR:Harrison |
| Ant-66950 | F2 | 0.37 | 0.63 | |
| Ant-66951 | F2 | 0.23 | 0.77 | |
| Ant-66952 | F2 | 0.49 | 0.51 | |
| Ant-66953 | F2 | 0.92 | 0.09 | |
| Ant-66954 | F2 | 0.44 | 0.56 | |
| Ant-66955 | GR Backcross | 0.57 | 0.44 | |
| Ant-66956 | F2 | 0.76 | 0.24 | |
| Ant-66957 | F2 | 0.15 | 0.85 | |
| Ant-66958 | F2 | 0.38 | 0.62 | |
| Gun-66911 | CRR | 0.92 | 0.08 | unknown |
| Gun-66912 | CRR | 0.96 | 0.04 | CRR |
| Gun-66913 | CRR | 0.98 | 0.02 | CRR Backcross 2 |
| Gun-66914 | CRR Backcross | 0.97 | 0.03 | |
| Gun-66915 | CRR Backcross | 0.83 | 0.18 | |
| Gun-66916 | CRR | 0.69 | 0.31 | |
| Gun-66917 | CRR Backcross | 0.54 | 0.46 | |
| Gun-66918 | CRR Backcross | 0.51 | 0.49 | |
| Gun-66919 | CRR Backcross | 0.97 | 0.03 | |
| Gun-66920 | CRR | 0.83 | 0.17 | |
| Gun-66921 | CRR | 0.86 | 0.14 | |
| Gun-66922 | CRR Backcross | 0.93 | 0.07 | |
| Gun-66923 | CRR Backcross | 0.95 | 0.05 | unknown |
| Gun-66924 | CRR Backcross | 0.95 | 0.05 | |
| Gun-66925 | F1 | 0.81 | 0.19 | |
| Gun-66926 | CRR Backcross | 0.9 | 0.1 | |
| Gun-66927 | CRR Backcross | 0.97 | 0.03 | |
| Gun-66928 | CRR Backcross | 0.89 | 0.11 | |
| Gun-66929 | F2 | 0.71 | 0.29 | |
| Gun-66930 | CRR | 0.94 | 0.06 | |
| Gun-66931 | CRR | 0.91 | 0.09 | |
| Gun-66932 | CRR | 0.81 | 0.19 | |
| SFRG-66933 | CRR | 0.97 | 0.03 | CRR or CRR Backcross 2 |
| SFRG-66934 | CRR Backcross | 0.61 | 0.39 | |
| SFRG-66935 | CRR | 0.98 | 0.03 | |
| SFRG-66937 | F2 | 0.77 | 0.23 | |
| SFRG-66938 | F1 | 0.74 | 0.26 | |
| SFRG-66939 | CRR Backcross | 0.65 | 0.35 | |
| SFRG-66940 | CRR Backcross | 0.92 | 0.08 | |
| SFRG-66941 | CRR Backcross | 0.9 | 0.1 | |
| SFRG-66942 | CRR | 0.91 | 0.09 | |
| SFRG-66943 | F2 | 0.46 | 0.55 | |
| SFRG-66944 | CRR Backcross | 0.83 | 0.17 | |
| SFRG-66945 | CRR Backcross | 0.97 | 0.03 | |
| SFRG-66946 | CRR Backcross | 0.97 | 0.03 | |
| SFRG-66947 | CRR | 0.48 | 0.52 | |
| SFRG-66948 | CRR | 0.91 | 0.09 | |

| Table 5: STRUCTURE Aug 2006 unknowns admixture proportions | | | |
|---|---|---|---|
| | | **qCRR** | **qGR** |
| F1_aca.cag | | 0.32 | 0.69 |
| F1_aca.cag | | 0.62 | 0.38 |
| F1_aca.cag | | 0.44 | 0.56 |
| F1_aca.cag | | 0.95 | 0.06 |
| F1_aca.cag | | 0.17 | 0.83 |
| F1_aca.cag | | 0.24 | 0.76 |
| F1_aca.cag | | 0.96 | 0.04 |
| F1_aca.cag | | 0.90 | 0.10 |
| F1_aca.cag | | 0.54 | 0.46 |
| F1_aca.cag | | 0.72 | 0.28 |
| F1_aca.cag | | 0.69 | 0.31 |
| F1_aca.cag | | 0.31 | 0.69 |
| F1_aca.cag | | 0.06 | 0.94 |
| F1_aca.cag | | 0.06 | 0.95 |
| F1_aca.cag | | 0.92 | 0.08 |
| F1_aca.cag | | 0.66 | 0.34 |
| F1_aca.cag | | 0.05 | 0.95 |
| F1_aca.cag | | 0.98 | 0.02 |
| F1_aca.cag | | 0.96 | 0.04 |
| F2_aca.cag | | 0.97 | 0.03 |
| F2_aca.cag | | 0.54 | 0.47 |
| F2_aca.cag | | 0.83 | 0.18 |
| F2_aca.cag | | 0.68 | 0.32 |
| F2_aca.cag | | 0.98 | 0.03 |
| F2_aca.cag | | 0.85 | 0.15 |
| F2_aca.cag | | 0.61 | 0.39 |
| F2_aca.cag | | 0.84 | 0.16 |
| F2_aca.cag | | 0.97 | 0.03 |
| F2_aca.cag | | 0.88 | 0.12 |
| F2_aca.cag | | 0.24 | 0.76 |
| F2_aca.cag | | 0.66 | 0.34 |
| F2_aca.cag | | 0.85 | 0.15 |
| F2_aca.cag | | 0.99 | 0.01 |
| F2_aca.cag | | 0.18 | 0.82 |
| F2_aca.cag | | 0.55 | 0.45 |
| F2_aca.cag | | 0.85 | 0.15 |
| F2_aca.cag | | 0.99 | 0.01 |
| F2_aca.cag | | 0.86 | 0.14 |
| F2_aca.cag | | 0.61 | 0.40 |
| 8-06unknwn | 1 | 0.74 | 0.26 |
| 8-06unknwn | 2 | 0.93 | 0.07 |
| 8-06unknwn | 3 | 0.76 | 0.24 |
| 8-06unknwn | 4 | 0.95 | 0.05 |
| 8-06unknwn | 5 | 0.99 | 0.01 |

| | | | |
|---|---|---|---|
| 8-06unknwn | 6 | 0.91 | 0.09 |
| 8-06unknwn | 7 | 0.72 | 0.28 |
| 8-06unknwn | 8 | 0.93 | 0.07 |
| 8-06unknwn | 9 | 0.98 | 0.02 |
| 8-06unknwn | 10 | 0.97 | 0.03 |
| 8-06unknwn | 11 | 0.78 | 0.22 |
| 8-06unknwn | 12 | 0.81 | 0.19 |
| 8-06unknwn | 13 | 0.93 | 0.07 |
| 8-06unknwn | 14 | 0.97 | 0.03 |
| 8-06unknwn | 15 | 0.97 | 0.04 |
| 8-06unknwn | 16 | 0.55 | 0.45 |
| 8-06unknwn | 17 | 0.92 | 0.08 |
| 8-06unknwn | 18 | 0.93 | 0.07 |
| 8-06unknwn | 19 | 0.84 | 0.16 |
| 8-06unknwn | 20 | 0.98 | 0.02 |
| 8-06unknwn | 21 | 0.67 | 0.33 |
| 8-06unknwn | 22 | 0.87 | 0.13 |
| 8-06unknwn | 23 | 0.85 | 0.15 |
| 8-06unknwn | 24 | 0.79 | 0.21 |
| 8-06unknwn | 25 | 0.95 | 0.05 |
| 8-06unknwn | 26 | 0.96 | 0.04 |
| 8-06unknwn | 27 | 0.95 | 0.05 |
| 8-06unknwn | 28 | 0.95 | 0.05 |
| 8-06unknwn | 29 | 0.80 | 0.20 |
| 8-06unknwn | 30 | 0.64 | 0.36 |
| 8-06unknwn | 31 | 0.90 | 0.10 |
| 8-06unknwn | 32 | 0.93 | 0.07 |
| 8-06unknwn | 33 | 0.86 | 0.14 |
| 8-06unknwn | 34 | 0.93 | 0.07 |
| 8-06unknwn | 35 | 0.92 | 0.08 |
| 8-06unknwn | 36 | 0.81 | 0.19 |
| 8-06unknwn | 37 | 0.94 | 0.07 |
| 8-06unknwn | 38 | 0.88 | 0.12 |
| 8-06unknwn | 39 | 0.72 | 0.28 |
| 8-06unknwn | 40 | 0.99 | 0.01 |
| 8-06unknwn | 41 | 0.81 | 0.19 |
| 8-06unknwn | 42 | 0.87 | 0.13 |
| 8-06unknwn | 43 | 0.97 | 0.03 |
| 8-06unknwn | 44 | 0.97 | 0.03 |
| 8-06unknwn | 45 | 0.93 | 0.07 |
| 8-06unknwn | 46 | 0.94 | 0.06 |
| 8-06unknwn | 47 | 0.91 | 0.09 |
| 8-06unknwn | 48 | 0.93 | 0.07 |
| 8-06unknwn | 49 | 0.71 | 0.29 |
| 8-06unknwn | 50 | 0.80 | 0.21 |
| 8-06unknwn | 51 | 0.90 | 0.10 |
| 8-06unknwn | 52 | 0.85 | 0.15 |
| 8-06unknwn | 53 | 0.93 | 0.07 |
| 8-06unknwn | 54 | 0.83 | 0.17 |

| | | | |
|---|---|---|---|
| 8-06unknwn | 55 | 0.95 | 0.05 |
| 8-06unknwn | 56 | 0.88 | 0.12 |
| 8-06unknwn | 57 | 0.96 | 0.04 |
| 8-06unknwn | 58 | 0.89 | 0.11 |
| 8-06unknwn | 59 | 0.94 | 0.06 |
| 8-06unknwn | 60 | 0.95 | 0.05 |
| 8-06unknwn | 61 | 0.59 | 0.41 |
| 8-06unknwn | 62 | 0.94 | 0.06 |
| 8-06unknwn | 63 | 0.97 | 0.03 |
| 8-06unknwn | 64 | 0.30 | 0.70 |
| 8-06unknwn | 65 | 0.93 | 0.07 |
| 8-06unknwn | 66 | 0.98 | 0.02 |
| 8-06unknwn | 67 | 0.85 | 0.15 |
| 8-06unknwn | 68 | 0.96 | 0.04 |
| 8-06unknwn | 69 | 0.97 | 0.03 |
| 8-06unknwn | 70 | 0.86 | 0.14 |
| 8-06unknwn | 71 | 0.84 | 0.17 |
| 8-06unknwn | 72 | 0.91 | 0.09 |
| 8-06unknwn | 73 | 0.94 | 0.06 |
| 8-06unknwn | 74 | 0.93 | 0.07 |
| 8-06unknwn | 75 | 0.64 | 0.36 |
| 8-06unknwn | 76 | 0.79 | 0.21 |
| 8-06unknwn | 77 | 0.79 | 0.22 |
| 8-06unknwn | 78 | 0.83 | 0.17 |
| 8-06unknwn | 79 | 0.98 | 0.02 |
| 8-06unknwn | 80 | 0.60 | 0.40 |
| 8-06unknwn | 81 | 0.94 | 0.06 |
| 8-06unknwn | BOB 1 | 0.80 | 0.20 |
| 8-06unknwn | BOB 2 | 0.89 | 0.11 |
| 8-06unknwn | BOB 3 | 0.94 | 0.06 |
| 8-06unknwn | BOB 4 | 0.88 | 0.12 |
| 8-06unknwn | BOB 5 | 0.88 | 0.12 |
| 8-06unknwn | BOB 6 | 0.97 | 0.03 |
| 8-06unknwn | BOB 7 | 0.96 | 0.04 |
| 8-06unknwn | BOB 8 | 0.94 | 0.06 |
| 8-06unknwn | BOB 9 | 0.96 | 0.04 |
| 8-06unknwn | BOB 10 | 0.89 | 0.11 |
| 8-06unknwn | BOB 11 | 0.93 | 0.07 |
| 8-06unknwn | BOB 12 | 0.82 | 0.18 |
| 8-06unknwn | BOB 13 | 0.90 | 0.10 |
| 8-06unknwn | BOB 14 | 0.80 | 0.20 |
| 8-06unknwn | BOB 15 | 0.97 | 0.03 |
| 8-06unknwn | CHU-1-1 | 0.90 | 0.10 |
| 8-06unknwn | CHU-1-2 | 0.95 | 0.06 |
| 8-06unknwn | CHU-1-3 | 0.78 | 0.22 |
| 8-06unknwn | CHU-1-4 | 0.94 | 0.06 |
| 8-06unknwn | CHU-1-5 | 0.96 | 0.04 |
| 8-06unknwn | CHU-2-1 | 0.79 | 0.21 |
| 8-06unknwn | CHU-2-2 | 0.67 | 0.33 |

| | | | |
|---|---|---|---|
| 8-06unknwn | CHU-2-3 | 0.73 | 0.27 |
| 8-06unknwn | CHU-2-4 | 0.96 | 0.04 |
| 8-06unknwn | CHU-2-5 | 0.83 | 0.18 |
| 8-06unknwn | CHU-2-11 | 0.95 | 0.05 |
| 8-06unknwn | CHU-2-12 | 0.88 | 0.12 |
| 8-06unknwn | CHU-2-13 | 0.96 | 0.04 |
| 8-06unknwn | CHU-2-14 | 0.86 | 0.14 |

Figure 1

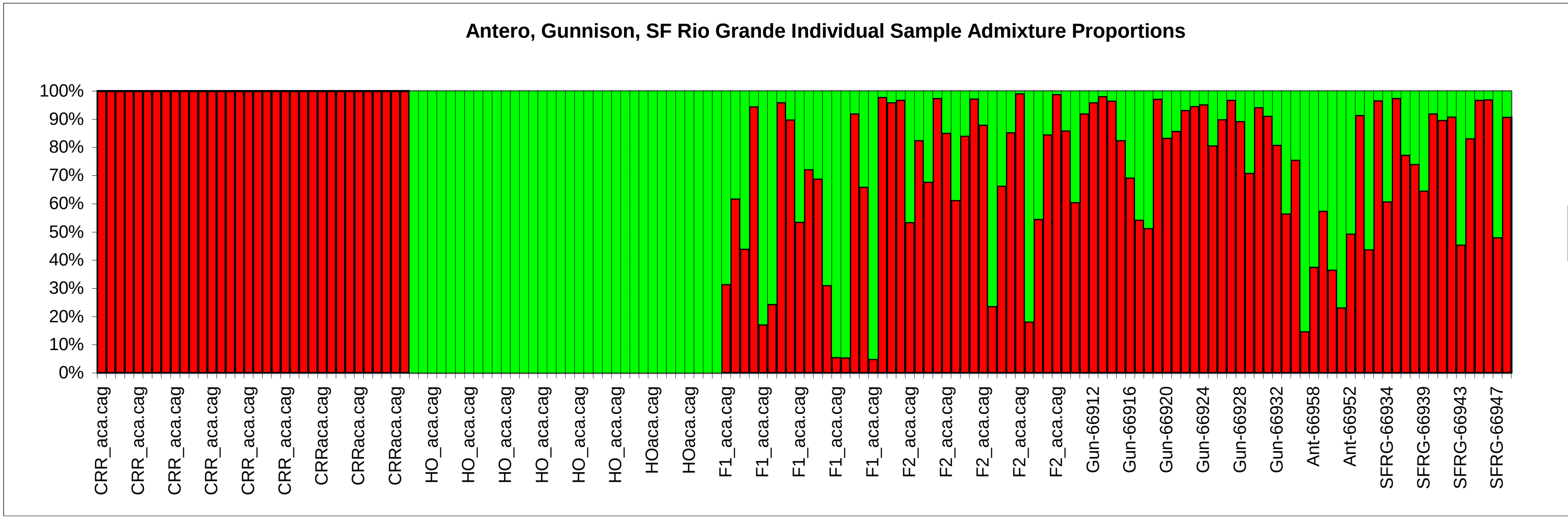



Figure 2