NOAA Technical Memorandum NMFS

MARCH 2009

CREATION OF A CAPTIVE BROODSTOCK PROGRAM FOR SOUTHERN COHO SALMON (Oncorhynchus kisutch): RESULTS FROM THE INITIAL REARING AND SPAWNING OF THE FIRST BROOD YEAR

Erick A. Sturm
Elizabeth A. Gilbert-Horvath
J. Carlos Garza
and
R. Bruce MacFarlane

NOAA-TM-NMFS-SWFSC-436

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
Southwest Fisheries Science Center

The National Oceanic and Atmospheric Administration (NOAA), organized in 1970, has evolved into an agency that establishes national policies and manages and conserves our oceanic, coastal, and atmospheric resources. An organizational element within NOAA, the Office of Fisheries is responsible for fisheries policy and the direction of the National Marine Fisheries Service (NMFS).

In addition to its formal publications, the NMFS uses the NOAA Technical Memorandum series to issue informal scientific and technical publications when complete formal review and editorial processing are not appropriate or feasible. Documents within this series, however, reflect sound professional work and may be referenced in the formal scientific and technical literature.

NOAA Technical Memorandum NMFS

This TM series is used for documentation and timely communication of preliminary results, interim reports, or special purpose information. The TMs have not received complete formal review, editorial control, or detailed editing.

MARCH 2009

CREATION OF A CAPTIVE BROODSTOCK PROGRAM FOR SOUTHERN COHO SALMON (Oncorhynchus kisutch): RESULTS FROM THE INITIAL REARING AND SPAWNING OF THE FIRST BROOD YEAR

Erick A. Sturm, Elizabeth A. Gilbert-Horvath,
John Carlos Garza, and R. Bruce MacFarlane

National Oceanic & Atmospheric Administration
National Marine Fisheries Service
Southwest Fisheries Science Center
Fisheries Ecology Division
110 Shaffer Road
Santa Cruz, California, USA 94920-1211

NOAA-TM-NMFS-SWFSC-436

U.S. DEPARTMENT OF COMMERCE
Gary F. Locke, Secretary
National Oceanic and Atmospheric Administration
Jane Lubchenco, Undersecretary for Oceans and Atmosphere
National Marine Fisheries Service
James W. Balsiger, Acting Assistant Administrator for Fisheries

ABSTRACT

Coho salmon (*Oncorhynchus kisutch*) from Scott Creek, Santa Cruz County, CA, USA, were captured as adults in the winter of 2001/02 to establish a captive broodstock program designed to reduce the risk of extinction of coho salmon at the southern end of their range following years of precipitous declines. These fish were spawned with a random mating design, and 154 progeny from these crosses were selected as founding captive broodstock fish using an *ad hoc* method based upon molecular genetic variation. The captive broodstock fish were divided into 3 groups of ~50 fish and were reared in seawater and freshwater at two different locations until just before reproductive maturity, when they were all consolidated at the freshwater facility for spawning. Total mortality (21%) was substantially less than the 50% expected from previous coho salmon captive broodstock programs. However, captive broodstock fish were 30-50% shorter and lighter than wild coho salmon from Scott Creek upon maturity in January 2005. The captive broodstock fish also had inferior measures of all reproductive traits, except gonosomatic index, relative to wild fish. In addition, significant differences in both size and reproductive traits were noted between fish reared in seawater and those reared in freshwater, with the freshwater-reared fish growing much more quickly during the last six months prior to spawning. Females from both rearing environments did not mature on the same schedule as the wild coho salmon and the majority of the captive broodstock fish, and they were treated with an experimental gonadotropin releasing hormone analogue. This quickly induced maturity, but the majority of eggs from these females did not survive. To create the next generation of captive broodstock fish, all mature wild and captive broodstock fish were mated together using a genetically-defined breeding matrix that relied upon the pair-wise coefficients of relatedness

between all potential mating pairs, as estimated with molecular genotype data from 18 microsatellite loci. This genetic broodstock management used a rapid genotyping effort for all returning adults and the iterative construction of breeding matrices to include all potentially available mates for each week's spawning event. The genetic matrices were not able to be fully utilized to create optimal crosses, due to asynchronous maturity and other logistical issues, but the mean coefficient of relatedness between mated pairs and the number of highly inbred matings were both dramatically reduced, relative to random mating.

INTRODUCTION

Central California Coast Coho Salmon Evolutionarily Significant Unit (ESU)

Pacific salmon populations have declined to fractions of their historical population levels over the past 100 years. Causes of these declines include a variety of both natural and man made factors such as drought, over-fishing, habitat loss and modification, water pollution, dams, and water diversions for other uses (CDFG, 2004). These population declines have led both the federal and California state governments to list many stocks of Pacific salmon as either threatened or endangered under federal and state Endangered Species Acts (ESA). However, listing a species of Pacific salmon over its entire range as threatened or endangered was impractical, because there is extensive population structure and the species may only be imperiled in a portion of its range. The National Marine Fisheries Service (NMFS) organized species of Pacific salmon into distinct population segments called Evolutionarily Significant Units (ESU); see Waples (1991) for a complete definition of an ESU as applied to Pacific salmonids. Application of the ESU concept and policy has allowed biologists and regulators to focus on specific populations of ESA-listed salmon for restoration purposes.

Coho salmon (*Oncorhynchus kisutch*) on the West Coast of the United States of America have been divided into seven ESUs (Weitkamp et al., 1995). The Central California Coast (CCC) ESU is the southernmost coho salmon ESU and ranges from Punta Gorda in Humboldt County, California (40°15’N, 124°21’W), to the San Lorenzo River in Santa Cruz County, California (36°58’N, 12°01’W) (Figure 1). In 1996, NMFS listed all coho salmon runs in the CCC ESU as Threatened (Federal Register, 1996) and in 2005 reclassified their status to Endangered (Federal Register, 2005). The California Department of Fish and Game

(CDF&G) listed all coho salmon south of San Francisco Bay as Endangered in December 1995 (CDFG, 2004).

Status of Scott Creek Coho Salmon

The southernmost persistent runs of coho salmon in North America are found in Scott Creek, Santa Cruz County, California. Scott Creek is a small coastal stream at the southern end of the CCC ESU, approximately 100 km south of San Francisco, California (See Hayes et al., 2004 for a more complete description of the Scott Creek watershed). Because southern coho salmon are essentially three-year-lifecycle fish, Scott Creek supports three largely demographically-independent runs of coho salmon; each run spawning in a different year (Table 1). The run that comprises the 1999, 2002, and 2005 brood years (BYs) is relatively strong and appears to be self-sustaining[1]. However, the run that comprises the 2000, 2003, and 2006 BYs is nearly extinct. In 2003, only five males were observed in Scott Creek, but at least two females spawned in the creek, as the fry from two redds were found during snorkel surveys (S. Hayes, personal communication). The run that comprises the 2001, 2004, and 2007 BYs is slightly more abundant than the 2000, 2003, 2006 BY-run (Table 1). Because of the small population numbers associated with two of the three runs in Scott Creek, and to promote the recovery and survival of southern coho salmon, a cooperative captive broodstock program was created in 2002 by the National Marine Fisheries Service, Southwest Fisheries Science Center, Santa Cruz Laboratory and the Monterey Bay Salmon and Trout Project (MBSTP), a local nonprofit organization dedicated to the restoration of native salmonids in the Monterey Bay area.

---

[1] Coho salmon spawning runs in CCC ESU south of the Golden Gate occur primarily during December to February. Spawning run, and BY, are designated by the year in which over 50 % of the eggs were fertilized.

Program Goals

The coho salmon captive broodstock program has three goals: 1) to maintain and increase the population sizes of the Scott Creek coho salmon runs, particularly in years with few or no returning adults, by supplying sexually mature fish to supplement the returning wild adults collected for spawning at the MBSTP hatchery, 2) to maintain genetic diversity in the Scott Creek coho salmon population by minimizing inbreeding in artificial propagation at the MBSTP hatchery, through use of a breeding matrix that uses coefficients of relatedness of all potential mating pairs estimated from molecular genotype data, and 3) to produce sufficient numbers of fish for all three Scott Creek runs to promote both natural straying and assisted transplantation into neighboring streams, thereby reintroducing or augmenting existing coho salmon stocks. This program will continue for at least nine years, or three complete life cycles of each run lineage in Scott Creek.

METHODS

Selection of Captive Broodstock

Capture of Mature Wild Coho Salmon

Captive broodstock fish are the progeny of wild fish collected from Scott Creek that were artificially spawned at MBSTP's Kingfisher Flat Genetic Conservation Fish Hatchery (hereafter referred to as the hatchery) on the Big Creek tributary of Scott Creek, at the site of the California Department of Fish and Game's former Big Creek Hatchery. The hatchery is located approximately two miles upstream of a resistance-board weir with a fish trap that was installed in the winter of 2003/04 and that is operated by the NMFS/Santa Cruz Laboratory. In December 2001 and January 2002 (i.e., BY 1999), wild coho salmon were caught in Scott Creek by snorkelers chasing the fish into large nets. Captured fish were weighed, measured, and identified as wild or hatchery fish, with absence of the adipose fin indicating hatchery origin. A DNA sample was taken from a caudal fin clip, a scale sample taken for age determination, and all fish were tagged with numbered, color-coded Floy® tags. Only wild fish were used for artificial propagation. Every fourth fish captured was taken to the hatchery in a 91-liter ice chest filled with water. At the hatchery, females were given an injection of erythromycin (40 μg/kg body weight) as a prophylaxis against bacterial kidney disease (W. Cox, CDFG, pers. comm.). All fish were put into a 6.1-m diameter by 1-m deep tank (29,200 l) and held until they were ready to spawn. The holding tank was supplied with unfiltered creek water and supplemental air.

First Year Rearing at the Hatchery

The sexually mature adults taken to the hatchery were spawned using a ratio of four males to each female. Eggs from each female were divided into two portions and each portion was fertilized by milt from two males. Each male was spawned with no more than four females, with the distribution of mates per male ranging from one to four (mean number of mates 3.1). Thus, for every three females, milt from approximately four males was used. After hatching, coho salmon fry were transferred from the incubator trays to freshwater troughs once they reached the "swim up" stage. Fry were fed a daily ration of dry pellet food (Nelson's Silver Cup slow sinking Pacific Salmon feed, Nelson and Sons, UT, USA), based on the size of the fish, total weight of the fish in the tank, and water temperature following standard hatchery practice (3.8-5.1% of body weight/d). The fish were periodically weighed and measured and their ration increased as they grew. Once they reached an average size of approximately 2.5 g/fish they were moved to outdoor holding facilities, either of two U-shaped (cross section) raceways approximately 30 m long by 1 m deep by 10 m wide

(160,000 and 171,000 l, respectively) or into 6.1-m diameter by 1.22-m deep pools (35,636 l). All raceways and holding tanks were supplied with flow-through, unfiltered creek water. Supplemental air was supplied to each raceway and tank to prevent oxygen depletion and to help drive water currents. The water from the tanks drained directly back to the creek. The outdoor raceways and tanks were inside I-beam structures covered by shade cloth and netting to provide shade and exclude predators. The fish were fed by hand in the morning and evening and via automatic feeders hanging over the raceways or tank every three hours during the day.

Broodstock Selection

In December of 2002, 500 juvenile coho salmon were randomly selected from the approximately 30,000 at the hatchery and were weighed, measured, injected with Passive Integrated Transponder (PIT) tags (Biomark, Inc., Boise, ID), fin-clipped for DNA analysis, and placed into a separate pool at the hatchery. Following this separation, the 500 juvenile fish were analyzed using 12 microsatellite DNA markers (Table 2) to assist in the selection of 154 final candidates for retention as broodstock. Because there is substantial disequilibrium (correlations between allelic variants at different genes) in small populations, each allele is actually representative of variation in a larger section of the genome. Much of this variation is unexpressed but can be crucially important for many aspects of fitness. So an *ad hoc* procedure was developed to maintain all allelic variants at the 12 microsatellite loci in the 154 fish retained as broodstock. The procedure focused on rare alleles (frequency of < 5% or 50 copies in the 500 fish) and analysis went gene by gene, allele by allele, choosing fish such that each rare allele was to be present in more or less the same frequency in the smaller group. Fish were also chosen such that every genotype with that rare allele was present in the sample of 154 fish retained for broodstock. So, for example, if 12 copies of that rare allele were needed to maintain its frequency, the choice of fish was such that every unique genotype, or combination of that allele and another allele at that locus, was present in the smaller sample. Once that was done, the remaining choices were drawn somewhat at random, but such that they reflected the frequency of the other alleles present in the original 500 fish. This procedure led to the selection of 154 fish that had all of the rare alleles, in roughly the same proportion as in the original 500. The other alleles, however, did not necessarily have exactly the same frequency, but the 150 retained fish were not genetically differentiated from the original 500 ($F_{ST} = 0.009$, $p > 0.05$).

The male-to-female ratio in the 154 fish selected as captive broodstock was unknown, but it was determined that obtaining a sufficient number of mature females from this sub-group was not a concern, given the relatively large number of fish retained and information about sex ratio in other juvenile salmonids. In February of 2003, the 154 fish were placed into their own tank and held at the hatchery until April 2003, when they were separated into three groups for freshwater and seawater rearing.

Rearing Conditions

At smoltification, all fish were immersed in a Vibrogen® 2 bath (manufactured by Aqua Health LTD., Charlottetown, P.E.I., Canada for Novartis Animal Health US Inc., Larchwood, Iowa.) to vaccinate against vibriosis. The vaccine bath consists of formalin-preserved *Vibrio anguillarum* and *V. ordalii* and was administered following the manufacturer's directions. Briefly, the concentrated vaccine (1 l) was diluted with 9 l freshwater and 500 g of fish were immersed in the bath for a minimum of 30 seconds. Once vaccinated, they were randomly placed into three groups of approximately 50 fish each to be reared at two different locations to prevent a catastrophic accident at one facility from killing the entire broodstock. Two groups of fish were transferred to the seawater facility at the NMFS Santa Cruz Laboratory, in a 778-l transfer truck. The water inside the transfer tank had a salinity of 16 psu to help the fish adjust to seawater, because once at the NMFS lab they were placed directly into full strength seawater (33 psu). The third group was kept in the same freshwater tank at the hatchery.

Seawater Rearing

The 106 captive broodstock reared in seawater were kept in two tanks 3.65 m in diameter and 1.75 m deep (18,300 l). Each tank was supplied with sand-filtered and ultraviolet light-sterilized seawater. A portion of the water supplied to each tank was passed through a countercurrent heat exchanger to maintain the cool temperature of the water in the tanks. The desired water temperature in the seawater tanks was 12 °C ± 1 °C; however, the water temperature in the tanks ranged from 10.5 °C in the winter months to 14.5 °C in the summer months (Figure 2). The water entered the tanks approximately 0.45 m off the bottom of the tank through a 2.5 cm diameter 90° elbow to create a circular water flow in the tank. Supplemental aeration was added to each tank, and the dissolved oxygen (DO) content was monitored using a YSI 5200® probe. DO values ranged between 5.9-7.2 mg/l depending on the temperature and water input rate into the tanks. The water input rates into the tanks ranged from 500 ml/sec when the fish first arrived (June 2003) to 1,500 ml/sec as they reached final maturity (December 2004). A flow rate of 1,500 ml/sec created a current velocity of 0.1m/sec in the tank. All tanks were single pass flow-through, and the water in each tank turned over four to six times each day, so biological filtration of the tank water was not necessary. Water height in all tanks was controlled via an external standpipe and the untreated effluent returned to the ocean via the University of California Santa Cruz's Long Marine Laboratory's seawater effluent line. This effluent water is tested quarterly to ensure no chemicals or pathogens are being released into the ocean.

Freshwater Rearing

The 48 freshwater-reared captive broodstock fish were kept in a 6.1-m diameter by 1.22 m deep pool (35,636 l). In December 2003, just before the fish turned 2^+ years of age, they were transferred to another holding tank 3.65 m in diameter and 1.75 m deep (18,300 l). Both rearing tanks were supplied with fresh, unfiltered creek water. Water temperature in the tanks varied with the temperature of the creek water and ranged from a low of 8 °C in December 2004 to a high of 17.6 °C in August 2003 (Figure 2). Water was supplied to the tanks at a minimum rate of 170 l/min via a 5 cm 90^0 PVC elbow to help create a circular flow of water in the tank. At this flow rate the water current speed in the tank was 0.4 m/s. All tanks were single pass flow-through, and the water in each tank turned over a minimum of 13 times each day, so biological filtration of the water was not necessary. All tanks received supplemental aeration via large air-stones positioned on the bottom of each tank near the water input pipe. The water height in all tanks was controlled via an external standpipe; the untreated effluent returned directly to the creek.

Lighting conditions

The seawater tanks were illuminated by both artificial and natural light. The artificial lights consisted of two fluorescent light banks; each bank contained two 1.29-m bulbs (T-8, 32 W) controlled by an automatic timer that was reset every two to three weeks (Appendix 1) to follow the natural light cycle for the latitude (36° 57'N) and longitude (122° 04'W) of the laboratory. Artificial lights were supplemental to the natural light that flowed into the broodstock facility via 1-m high openings around the top of the building 2 m above the floor. The natural light was attenuated by black tarps set approximately 0.3 to 0.6 m from the wall in front of the openings around the top of the building. On rainy or overcast days, the artificial lights supplied the majority of the illumination to the tanks. The freshwater tanks at the hatchery were located outdoors under shade cloth and protective netting and were only illuminated by natural light.

Feeding

The captive broodstock fish were fed a daily ration that was equal to 2% of the total biomass of all fish in a tank. This ration contained both dry-pellet commercial salmon food and a prepared "gel food" that was made at the lab. The pellet food was a 50:50 mixture of two commercially available salmon feeds (Bio Diet® Grower, Bio Oregon, Corvallis, OR and Vitalis SA®, Skretting Inc., Vancouver, BC, Canada). Feeding a mixture of two pellet foods insured that fish received all necessary nutrients, since the feed formulas of each manufacturer were slightly different. When the average fork length of all fish in a tank was over 230 mm, their pellet diet was switched to a dry "captive broodstock" pellet. These pellets were specifically formulated by each manufacturer for captive broodstock salmonids. As the broodstock continued to grow, the pellet size was increased to a maximum size of 9 mm. The prepared (gel) food contained fish (sardines, herring, or anchovies), squid, krill (freeze-dried), copepods (freeze-dried), multi-vitamins, amino acids, spirulina, and pellet food all ground up and held together in a gelatin matrix (Appendix 2). The gel food was cut into appropriate-sized cubes based on the size of the fish. Small fish (< 200 mm fork length) received a 1:1 ratio of gel food-to-pellets by weight; however, as the fish grew, they selected the gel food over the pellets, so the feeding ratio was changed to 3:1 gel food to pellets by weight. Finally, starting in the spring of the year they were to mature (2004), they were fed only gel food because they stopped eating the pellets. The feeding ration was adjusted every time the fish were weighed and measured (Table 3), with minor adjustments inside this period to account for their growth between weighing periods. After the June 2004 weighing and measuring event, the fish were no longer weighed and measured. To account for their continued growth, we adjusted their food ration upwards at a rate of 5 g/week. Beginning in mid-November 2004, the food ration was cut down by 25% a week until the fish were no longer being fed. Tyler et al. (2001) found that as sockeye salmon in Alaska approach freshwater for spawning, they start to taper their feeding off, and we assumed wild coho salmon in Scott Creek would follow a similar pattern.

In April of 2003, when the 2002-BY captive broodstock fish were transferred to seawater tanks, they were fed about a third of their ration in the morning by hand, and the rest of the ration was placed on a 12-hr belt feeder (Zigler Brothers, 12-hr Baby Belt®) that was attached to the lip of the tank. The belt feeders allowed the pellet food to be slowly fed to the fish over the entire day while the lights were on. However, the fish were not eating the majority of the food fed to them by the belt feeder. As the food fell into the tank from the belt feeder it stayed next to the tank wall as it sank to the bottom, and if the fish were not directly under the feeder they did not notice it. The captive broodstock fish would not eat food off the bottom of the tank. After discovering this problem, they were fed twice a day by hand, 50% of the ration in the morning and 50% in the late afternoon. Once the daily ration increased to over 250 g/d/tank, feedings were increased from two to three a day, in the morning, at noon, and in the late afternoon. Each feeding period lasted several minutes and the food was broadcast over the entire surface area of the tank to allow all fish a chance to eat.

At the hatchery, the fish were fed gel food twice a day by hand, in the morning and in the early evening. The pellet rations were distributed three times a day over the entire tank surface by an automated feeder hanging over the tank. Once the feed ration was over 250 g/d/tank the fish were fed gel food three times a day (morning, noon, and early evening) by hand because the freshwater-reared captive broodstock would not eat food off the bottom of the tank either.

Ultrasound Sex Determination

In mid December 2004, all captive broodstock fish were weighed and measured a final time before spawning (Table 3) and also given an ultrasound examination to determine their sex. Briefly, the fish were anesthetized using MS-222 (0.1 g/l) buffered with sodium bicarbonate (0.4 g/l). Once the fish were unresponsive, they were weighed, measured, scanned for their PIT tag number, held upside down in a water bath without anesthetic, and scanned with a Shimadzu 350XL® portable ultrasound machine with a 7.5 MHz probe. This entire procedure took 1-2 minutes. If the sex of a fish was determined, then it was tagged with a color-coded, numbered Floy® tag just below the dorsal fin. The Floy tags enabled the tracking of each individual fish and allowed easy separation of the wild fish from the captive broodstock fish and the males from the females at each spawning check. The Floy tag numbers were also used to identify each individual fish in the spawning matrix (see Table 4). Floy-tagged fish were assumed to be mature and were returned to one of the two holding tanks. In January and February 2005, the seawater-reared fish were returned to the hatchery to spawn. Immature fish did not receive a Floy tag and were returned to the other tank and later released into Pescadero Creek (San Mateo County, CA, USA), which historically supported coho salmon but did not at the time of release.

Spawning

Transferring Seawater- and Freshwater-Reared Captive Broodstock to the Spawning Tank

The mature captive broodstock fish reared in seawater were returned to freshwater at the hatchery in early January and February 2005 in preparation for spawning. The fish were transferred in a 757-l tank supplied with supplemental oxygen. The salinity in the transfer tank was set at approximately 16 psu to ease the transition to freshwater and to reduce the stress of moving from full strength seawater (33 psu) to freshwater over a one-hour travel period. The fish were transferred at two different times to have fish ready to spawn over the entire course of the natural spawning period of the wild coho salmon. In Scott Creek, the wild coho salmon spawning period is from mid-December or early January to early March (Shapovalov and Taft, 1954). However, in many years, fish cannot enter Scott Creek, and many other central California streams, until mid to late January because winter storms have not produced sufficient rainfall to breach the sand bars blocking the mouth of the stream to the ocean. In contrast to the seawater-reared captive broodstock, all of the freshwater-reared captive broodstock were transferred at one time to the spawning tank in mid January 2005.

Holding of Mature Adults for Spawning

All mature captive broodstock fish were placed into a 6.1 m diameter by 1.22 m deep holding tank (35,636 l) that also contained the captured wild coho salmon to be spawned at the hatchery. When captive broodstock fish were transferred to the holding tank, they were chrome in color and showed no secondary sexual characteristics. Within a few weeks of being transferred to the pre-spawn holding tank with the wild fish, they began to darken and the males began to develop kypes. All fish in the holding tank were checked twice a week to determine their state of maturity and to ensure they were progressing towards final maturation. Captive broodstock females that were not progressing towards final maturation at an acceptable rate to use the pairing recommendations of the genetic breeding matrix were injected with Ovaplant® (75 µg pellets, Syndel International, Inc., Vancouver, B.C., Canada) a synthetic gonadotropin releasing hormone analog (GnRHa). Ovaplant was obtained under an investigational new animal drug (INAD) permit from the United States Food and Drug Administration (FDA). For more information on Ovaplant see Powell et al. (1998).

Spawning Wild and Captive Broodstock Coho Salmon

Semi-weekly examination of all fish required them to be netted from the holding tank and sorted by sex into two smaller holding tanks. Females were then individually anesthetized using MS-222 (0.1 g/l) buffered with sodium bicarbonate (0.4 g/l), and manually examined to determine their ripeness. The stage of color development and ripeness level (hard, starting to soften, soft but no loose eggs, soft with a percentage of loose eggs, ripe), as determined by the hatchery manager were recorded and unripe females were returned to the main holding tank. Ripe females were placed in a small holding tank until all females had been checked. Males that were to be spawned with a female were removed from the male tank and placed into another small holding tank until all males needed for spawning were collected. At the first spawning check of the season each male was checked to see if it was producing milt. It was noted which males produced milt, and any males that did not were checked weekly until they produced milt. The MBSTP hatchery staff dry fertilizes salmon eggs (Soudakevicz, 1874). Briefly, dry fertilization entails collecting gametes in separate containers without water or ovarian fluid present, mixing the gametes together, and adding water to activate the milt, thereby allowing fertilization to occur. Eggs from ripe females were stripped into a colander to allow ovarian fluid to drain off. Milt from the four males to be spawned with each female was expressed into individually labeled containers and the motility of the sperm checked using a microscope. If less than half the sperm were actively swimming or the sperm appeared lethargic, it was discarded and another male was selected from the genetic matrix and his milt was collected, examined and used, if sufficiently motile. The eggs from each female were divided into two lots of approximately equal numbers and each lot was then fertilized by milt from two males by putting the milt directly onto the eggs, then covering them with just enough stream water to activate the sperm and allow fertilization to occur. After fertilization, the eggs were water hardened for three minutes and rinsed of excess milt. Unfertilized eggs were removed, and the fertilized eggs were put into a 100 ppm iodine bath (Argentyne, Argent Chemical Labs, Redmond, WA.) for one hour to kill any bacteria on the eggs (protocol from W. Cox, California Department of Fish & Game, pers. comm.). The fertilized eggs were rinsed and placed into an upwelling jar (3.33 cm x 11.5 cm, 0.77 l) where they were incubated until the eyed egg stage. Upwelling jars allowed dead eggs to slowly migrate to the top of the jar where they were removed before they could decompose and become infected with fungus (*Saprolignia*) that could spread to live eggs. Once the embryos reached the eyed stage ("eyed eggs"), they were transferred to Heath Vertical Incubator Trays® until the "swim-up" stage. Swim-up fry were then transferred to deep dark troughs (0.61 m x 9.75 m x 0.38 m deep). Each female's brood was reared separately to allow the hatchery staff to track the hatching success from each female. Family groups (all offspring of one female and four males) were not mixed together until the fry were put into large troughs for first feeding and initial rearing.

Molecular Genetics

Genotyping

To maximize genetic diversity in the Scott Creek coho salmon population and to avoid inbreeding, spawning at the hatchery utilized both returning wild fish captured at the Scott Creek weir and first-generation captive broodstock fish in an integrated manner. During the spawning season, from approximately mid-December 2004 to March 2005, adult wild coho salmon were captured at the Scott Creek weir, and every fourth male and every fourth female were taken to the hatchery for spawning. All fish to be used in spawning were genotyped before mating. The captive broodstock fish were genotyped in the year prior to reproductive maturation, but the inclusion of wild fish into the spawning matrix required a novel process of rapid genotyping and real-time construction of spawning matrices. When the fish were captured at the weir, a small piece ($2mm^2$) of caudal fin was excised for genetic analysis and placed in a desiccator until DNA extraction. DNA was then extracted using a DNeasy® Tissue kit (Qiagen, Inc.). Eighteen polymorphic microsatellite DNA markers (Table 2) were amplified using polymerase chain reaction (PCR). The 12 microsatellite markers used for broodstock selection were a subset of these 18 markers. Single-locus PCRs contained 1.5 mM $MgCl_2$, 0.1 mM dNTPs, 0.2 units AmpliTaq® DNA Polymerase (Applied Biosystems, Inc.), 4.0 µL DNA template and 0.17 µM each primer in 15 µL total volume. Thermal cycling conditions are available from the authors upon request. The forward primer was labeled with a fluorescent dye for visualization of PCR products on ABI 377 automated sequencers (Applied Biosystems, Inc.). Allele sizes were determined with the fragment analysis software package Genotyper, Version 2.1 (Applied Biosystems, Inc.). Two people made each allele call independently and resolved any discrepancies together to minimize genotyping errors.

Spawning Matrix

Coho salmon mating at the hatchery was conducted using a breeding/spawning matrix based on the microsatellite genotype data. The spawning matrix was created by calculating the relatedness coefficient r_{xy} for all possible pairs of 1 female and 1 male available for breeding, using the program Kinship, version 1.3.1 (Queller and Goodnight, 1989). Under conditions of random mating, the expectation for the relatedness coefficient is $r_{xy} = 0$ for unrelated individuals, 0.25 for half-siblings, and 0.50 for full siblings. The matrix was organized such that every female had a column with all potential mates listed beneath her (see Table 3). Mates for each female were ranked according to their coefficient of relatedness, such that the most desirable (least genetically-related) mates were at the top of the list and the least desirable (most genetically-related) mates were at the bottom. To reduce the potential for inbred progeny, due to mating between siblings or other close relatives, males related to the focal female at greater than $r_{xy} > 0.25$ (half-sibling level) were not listed as potential mates for that female.

Cryopreservation of Milt

A coho salmon cryopreserved milt bank was created to ensure a female's eggs would not be lost because milt was unavailable from live males and to more fully avoid inbreeding. The cryopreserved milt bank also acted as an emergency milt reservoir in case no males returned or matured the following year, or if the males that did mature and return were too closely related to the females. Cryopreserved milt was kept for one year. However, cryopreserved milt was not used to fertilize eggs during the 2005 spawning season. Milt was periodically collected from ripe male coho salmon, both wild and captive broodstock fish, throughout the spawning season, checked for motility and then cryopreserved. Milt was cryopreserved following a protocol obtained from the Coleman National Fish Hatchery (U.S. Fish & Wildlife Service, Anderson, CA). Briefly, milt was obtained from both wild and captive broodstock by gentle squeezing from anterior to posterior along the ventral sides of lightly-anesthetized males. The milt was then mixed with a preservation solution (distilled water, dextrose, DMSO, and yolk from a chicken egg) and placed in a labeled 1.8 ml Nalgene® cryopreservation vial and flash frozen on dry ice. See Appendix 3 for the full cryopreservation instructions. The label contained the fish's Floy Tag number, date of collection, and vial number out of the total number of vials frozen from that fish. In the lab, all vials were placed into cryopreservation sleeves to prevent leakage and put into liquid nitrogen for storage. To use the cryopreserved milt, a vial was thawed in a water bath at 5 ^{0}C until the contents were slushy and the milt was then poured on top of the eggs, followed by activator solution (NaCl, tris base, glycine, theophylline, and distilled water) to activate the milt.

Growth

All captive broodstock fish were weighed and measured before being transferred to their respective rearing locations (freshwater or seawater). They were periodically weighed (nearest 0.1 g) and measured (nearest mm fork length, FL) until June of the year when they were 2^+ (i.e., 2004) (Table 4). From the periodic length and weight measurements, average daily growth rates and condition factor (K) over each measuring period were calculated for all fish in a tank (Table 2) Weighing and measuring stopped in June 2004 because the fish were undergoing rapid gametogenesis and repeated stress during weighing and measuring events might have adversely effected gamete maturation. The fish were weighed and measured a final time in December 2004, prior to being returned to the hatchery for spawning, to obtain a final growth measurement. An ultrasound examination to determine sex was also performed on each fish at this time. Prior to being weighed and measured, rations were withheld from all fish for 24 hours to allow them to clear any food in their digestive tracts. Past experience indicated that fish with full stomachs and digestive tracts react differently to anesthesia and it is much harder to anesthetize and revive them when they have full stomachs.

Mortality

If a fish died, it was removed from the tank, scanned for its PIT tag number, weighed, measured, and a necropsy was performed. The necropsy looked for obvious signs of disease, parasites, or an obvious cause of death for the fish but did not check for any bacterial or viral infections.

Reproductive Data Recording

At spawning, the following data were recorded for females: total weight of released eggs, the number of eggs per gram (estimated by weighing 1 g of eggs and counting the number of eggs), and the total number of eggs released from the skein (estimated by multiplying the total weight of eggs released by the number of eggs per gram). The gonosomatic index (GSI) was calculated for each female. As the eggs matured, the number of eyed eggs and the number of swim-up fry were counted.

Statistics

The following physical and reproductive measurements of all three groups of female fish (wild, seawater-, and freshwater-reared) were compared using a one-way ANOVA with

Systat 11.0 (Systat Software Inc.): fork length, weight, number of eggs per gram (this relates to the size of the eggs), total number of good eggs released from the skein, number of eyed eggs, and number of swim-up fry. When significant differences were detected among the groups, Tukey's multiple contrast test was conducted *a posteriori* to further analyze the data. Gonosomatic indices for each group were compared with a one-way Kruskal-Wallace test, because the variances were unequal, using Systat 11.0 (Systat Software Inc.). Student's t-tests were conducted between Ovaplant-implanted and naturally-maturing captive broodstock females for the above-listed traits using Systat 11.0 (Systat Software Inc.). For males, length and weight among groups (wild, seawater-, and freshwater-reared) were compared using a one-way ANOVA. When significant differences among the groups were detected, Tukey's multiple contrast test was conducted *a posteriori* to further analyze the data.

RESULTS

Mortality

Thirty of the 108 (28 %) coho salmon reared in seawater died. The deaths fell into three categories: 1) fish with over-inflated swim bladders (N = 7), 2) fish with no obvious cause of death (N = 7), and 3) fish that appeared to die due to stress (N= 15).

Two of the 46 (4 %) freshwater-reared coho salmon died. One fish died after it broke its spine by swimming into the tank wall at high speed when startled. The other fish looked normal both internally and externally, and there was no obvious cause of death.

Size and Growth

The average fork lengths and weights of the captive broodstock fish at smoltification (April 2002) were 163 mm, 59.5 g and 167 mm, 60.2 g for fish in the two seawater tanks and 165 mm, 59.9 g for fish in the freshwater tank (Table 4). From these initial mean sizes, the fish grew to final (December 2004) average lengths and weights of 357 mm, 711 g and 363 mm, 767 g for fish in the two seawater tanks and 427 mm, 1264 g for fish in the freshwater tank. These averages include both fish that grew large enough to spawn and those that did not. At the end of the growth and maturation phase, the size distribution of the fish in both the seawater and freshwater tanks covered sizes from 230 mm to 560 mm.

The average daily growth rate, length and weight of all fish in each of the tanks were found to differ among the measurement periods (Table 4). However, over the last 8-9 months in the rearing tanks, the freshwater-reared coho salmon grew faster than the seawater-raised fish. The average condition factor (K) of all fish in each tank also varied between the measurement periods (Table 4). There was no consistent pattern of increasing or decreasing K for any tank over time. The average K of all the fish in a tank ranged from a low of 1.07 to a high of 1.61, indicating that the fish were healthy.

Comparisons of Size and Growth between Groups of Mature Coho Salmon

Wild vs. Captive Broodstock Females

The average FL of the mature captive broodstock females was significantly shorter ($P < 0.001$) than the average FL of the mature wild coho salmon females (Table 5). The average length of the mature seawater- and freshwater-reared captive broodstock females were 194 mm and 128 mm FL shorter than mature Scott Creek wild females, respectively. The average weight of the captive broodstock females was significantly less ($P < 0.05$) than the mature wild females. The mature seawater- and freshwater-reared captive broodstock females average weight were 1765.3 g and 1319.5 g less, respectively, than mature wild female coho returning to Scott Creek.

Seawater- vs. Freshwater-reared Females

The seawater-reared females were shorter and lighter than the freshwater females, on average (Table 5). However, the only statistically significant difference between the two groups of captive broodstock females was in FL, where the seawater-reared females were significantly shorter ($P < 0.05$) than the freshwater-reared females.

Ovaplant-injected vs. Naturally-maturing Females

The Ovaplant-injected female group was slightly longer and heavier on average than the naturally-maturing captive broodstock females (Table 6), even though both groups contained fish reared in both seawater and freshwater. However, there was no significant difference in length or weight between groups.

Males

The average FL of the mature seawater- and freshwater-reared captive broodstock males was also significantly smaller ($P < 0.05$) than the average FL of the mature wild males. The average FL of both the mature seawater- ($N = 6$) and freshwater-reared males ($N = 8$) was 468 mm, while the average fork length of the wild males ($N = 22$) was 618 mm. Both groups of mature captive broodstock males were also significantly lighter ($P < 0.05$) than the mature wild males. The average weight of the mature seawater- and freshwater-reared males was 1606 g and 1555 g respectively, while the average weight of the wild males was 2841 g. There were no significant differences ($P > 0.05$) in length or weight between the mature captive broodstock males reared in seawater and freshwater.

Comparison of Reproductive Characteristics between Different Groups of Females

Wild vs. Captive Broodstock

The wild females had higher average values for physical and reproductive characteristics than did the captive broodstock females in all but one category, gonosomatic index (GSI) (Table 5). Wild females were longer, heavier, had a greater total mass of eggs, had larger eggs, had more eggs eye up, and produced more swim-up fry. All of these comparisons were statically significant ($P < 0.05$). The seawater-reared females had the highest GSI, but there were no statistical differences ($P > 0.05$) between the average values of any of the three female groups.

Seawater- vs. Freshwater-reared Captive Broodstock Females

The seawater-reared captive broodstock females had lower values than the freshwater-reared captive broodstock females for all reproductive characteristics, except GSI (Table 5). They had lighter masses of eggs, smaller eggs, fewer numbers of eggs, fewer eggs eye up, and fewer eggs hatch. However, because of high variability among individuals in each group, there were no statistically significant differences between the two groups for any of the reproductive characteristics.

Ovaplant-Injected vs. Naturally-maturing Captive Broodstock

For all but one of the reproductive characteristics, the Ovaplant-injected females had lower values, although not statistically significantly so, than did the naturally-maturing captive broodstock females (Table 6). The Ovaplant-injected females had smaller egg masses, fewer eggs per gram, fewer total eggs, fewer eyed eggs, and had fewer eggs hatch-out than naturally-maturing females. Naturally-maturing females had significantly more eggs survive to the eyed stage than did Ovaplant-injected females ($P < 0.05$); however, there was no significant difference ($P > 0.05$) between the two groups in the total numbers of eggs that hatched.

Comparing the physical characteristics of Ovaplant-injected females to naturally-maturing females revealed that Ovaplant-injected fish were slightly longer and heavier than the naturally-maturing females (Table 6) but there was no significant difference ($P > 0.05$) between the two groups in either category.

Genetic breeding/spawning matrix utilization

Because of the dynamic nature of timing of adult return and of subsequent reproductive maturity**,** genetically-defined breeding matrices were constructed on a weekly basis to guide mating between all captive broodstock and wild fish potentially available for spawning that week. Matrices were constructed and provided by Monday morning of each week for a total of 7 weeks starting with the week beginning on January 10, 2005 and continuing until the week beginning with February 21, 2005, when all captive broodstock females had either spawned or died, and coho salmon no longer returned to Scott Creek. These matrices are all found in Appendix 4.

Thirty-two female coho salmon were spawned in 2005: 15 wild, 12 captive broodstock, and 5 hatchery-produced, ocean-going fish (these five fish are included in the wild N in Table 5). Thirty-three males were spawned in 2005: 19 wild and 14 captive broodstock fish. Every female fish was spawned with four males, and the males were spawned with one to eight fish (average number of spawning partners = 3.88), for a nearly one to one spawning ratio. Because of asynchronous reproductive maturity and other logistical issues, females were generally not mated with the most unrelated potential males (Figure 3). The average value of pairwise r_{xy} between mated pairs was –0.055, whereas the average value of pairwise r_{xy} that would have resulted if all females were mated with only the most unrelated males is –0.269. Random mating would have resulted in pairs with average pairwise r_{xy} of 0.008. The number of highly inbred matings (r_{xy} for mated pair>0.250) actual performed was three, whereas utilizing only the least related males as mates would have prevented all inbred matings, with the highest r_{xy} value for a mated pair of –0.158. Random mating, in contrast, would have resulted in 12 highly inbred matings (Figure 3).

DISCUSSION

A captive broodstock program for the southernmost run of coho salmon in North America was successfully initiated in Santa Cruz County through a cooperative effort by NMFS and MBSTP staff. The program started with the progeny of wild fish taken from Scott Creek, Santa Cruz County, CA, in the winter of 2001-2002, that were produced by undirected (random) mating at a small hatchery. These fish were held in captivity for their entire lives and were divided into groups that were reared for the majority of their development in either freshwater or seawater. A number of important differences were noted between coho salmon raised in freshwater and seawater, including differences in mortality rates, growth rates and in size at reproductive maturity. A subset of female fish from both the freshwater and seawater rearing tanks were treated with Ovaplant, an experimental GnRHa, in an attempt to synchronize reproductive maturity.

At reproductive maturation, the captive broodstock was mated using a series of breeding matrices created in real time that ranked all potential mates, from among both captive broodstock and wild returning adult salmon, according to their level of relatedness, as estimated by molecular genetic data from 18 microsatellite genes. These matrices were produced weekly and successfully reduced both the average level of relatedness within mated pairs and the number of highly inbred matings, although logistical issues did not allow them to achieve their full utility in reducing inbreeding. The integrated captive broodstock/wild coho salmon breeding scheme allowed the direct evaluation of physical and reproductive traits in the two groups of fish and several significant differences were observed, including substantial differences in length, weight, and fecundity.

Mortality

There was a difference in mortality rate between seawater- and freshwater-reared captive broodstock. Thirty out of 106 (28%)of the seawater fish died compared to two out of 48 (4%) of the freshwater-reared fish. Allee (1981) found that seawater-reared coho salmon did not survive to maturity as well as freshwater-reared coho salmon. The mortality events of the seawater-reared broodstock were divided into three groups: 1) those with an over inflated swim bladder (N = 8), 2) fish with no obvious cause of death (N= 7), and 3) fish that appeared to die due to stress (N = 15). For the swim bladder inflation group, their swim bladder slowly over-inflated and eventually blocked the esophagus, causing the fish to die of starvation. These fish were characterized by their abnormally large abdomen and loss of body mass and length, as their bodies metabolized both muscle and bone because the inflated swim bladder had blocked the esophagus and completely filled the abdominal cavity. To remedy this situation the pellet food was sieved to remove fine particles and dust in case this was causing a mechanical blockage of the pneumatic duct. This solved the problem of over-inflated swim bladders. However, necropsies were never performed to confirm mechanical blockage of the pneumatic duct. The freshwater-reared fish received the same food as the seawater-reared ones but did not have the same swim bladder inflation problem. There is no obvious explanation for the difference in swim bladder-related mortality between the two groups. The fish that died of no obvious cause looked normal. Necropsies were performed on these fish and they looked normal internally as well. No tests for bacterial or viral infections were performed, but there were no visual signs of disease on any of the internal organs. Mortality in the group that died due to chronic stress was attributed to stress by other fish in the tank. These fish were all characterized as very underweight for their length, and it appeared that they stopped eating and slowly starved to death. The issue of stress-related mortality is discussed in greater detail in the growth subheading of the discussion below.

The overall mortality rate (21%) for the captive broodstock program was less than expected, given that it was the initial attempt at rearing fish to maturity. Based on the start-up experience of other coho salmon captive broodstock programs, a 50% mortality rate was expected (Thomas Flagg, NMFS, Manchester, WA, pers. comm.). The initial number of coho salmon contributing to the captive broodstock program was determined by the conditions of MBSTP's permits from NMFS and CDFG, which allows them to spawn a total of 75 fish per year: 30 females and 45 males. Expecting a 50% mortality rate, 150 fish were retained to ensure that there would be 75 fish to spawn. In the future, it should be possible to hold fewer fish through their entire life cycle, thus decreasing the density of fish in the tanks and the consequent adverse social interactions, and still produce 75 mature adult fish. This lower density may also result in production of larger fish, to the extent that density effects played a role in the observed difference in size between captive and wild coho salmon.

Growth

Coho salmon smolts selected for the captive broodstock program were larger (in length and weight) than similarly aged (1^+) wild smolts found in Scott Creek (see Hayes et al., 2004 for the size range of wild coho salmon smolts in Scott Creek) and they remained larger than their wild counterparts for several months after being transferred to their rearing tanks (Figure 4). However, approximately four months after transfer, their growth rates (length and weight) slowed down, and from that point on they were smaller than what has been reported for wild coho salmon from Waddell Creek (located ~6 miles north of Scott Creek; Shapovalov and Taft, 1954) and wild coho salmon captured in the North Pacific Ocean (Ishida et al., 1998) (Figure 4). This faster growth in the wild fish resulted in wild returning males and females that were significantly larger ($P < 0.05$) than captive broodstock males and females.

The initially larger size of the captive broodstock smolts compared to wild smolts can be explained by the initial hatchery rearing conditions. The swim-up fry were fed a daily ration of up to 5% of the total biomass in a tank, which allowed them to grow very rapidly. However, lower growth rates through the captive period relative to wild stocks suggests that the size of the tanks may have been too small for the number of fish in each tank, which caused adverse behavioral interactions among the fish.

The size of the tanks and number of fish per tank may have created a density problem and facilitated antagonistic social interactions between the fish. The larger fish in a tank were up to twice the length and up to four times the weight of the smaller fish and were regularly observed attacking and chasing the smaller fish. This resulted in the larger fish monopolizing food resources, which may have stunted the growth of smaller fish. Additionally, in some cases, smaller fish appeared to starve to death because of the constant stress of being attacked and chased by the larger fish in the tank. An attempt was made to segregate the fish by size, but with a limited number of tanks, it was not possible to size-segregate the fish sufficiently to limit adverse social interactions. These behavioral interactions appear to have caused the broad size distribution observed in the captive broodstock fishes; the smaller adult salmon were the size of normal 18-month-old fish and were not sexually mature, whereas the larger fish were closer in size to wild adult fish and were sexually mature. Fagerlund et al. (1981) found that stress caused by overcrowding of young-of-the-year coho salmon had an effect on length and weight gain. This effect may also apply to the juvenile and sub-adult stages of coho salmon development. Excessive density in the tanks may have induced stress in the fish and caused them to grow slower than they would have in either larger tanks or tanks with fewer fish.

It is possible that the initial number of fish put into each of the rearing tanks (52, 54, and 48) was too high. This density may have resulted in the creation of several large dominant fish. Ryer and Olla (1996) found that dominant coho salmon in a tank could monopolize food resources and accelerate their growth at the expense of other fish in the tank. During feeding, the largest fish were the most aggressive and ate first while the smaller fish waited for food to sink lower in the water column or until the larger fish stopped feeding. The feeding patterns observed in the rearing tanks contrast with what has been reported for wild coho salmon that form small schools of 20-30 individuals that disperse to feed (Gribanov, 1948) then re-form the school after feeding (Burgner, 1980). The number of fish in each tank and the size of the tank prevented the fish from dispersing to feed.

In spite of these adverse behavioral interactions, it does not appear that the tanks were overstocked with fish biomass from a physiological perspective. The maximum biomass in any of the rearing tanks was 28 kg in 18.3 m^3 of water for a density of 1.53 kg/m^3. Based on Piper's (1975) density formula with our tank volume (18.3 m^3), water flow rate (1.5 l/sec), and fish that averaged 400 mm FL, the tanks could have been stocked with up to 120 kg/m^3

of coho salmon. Ellis et al. (2002) reviewed the effects of stocking density on the health of rainbow trout and found that the stocking density depended on the style of tank (circular, rectangular, etc.) with densities for tanks ranging from 43 kg/m^3 to under 267 kg/m^3. Blackburn and Clarke (1990) found that age 0 coho salmon fry could be reared at densities of up to 25 kg/m^3. The stocking densities in the captive broodstock tanks were all much less than any of these values and the volume of each tank was sufficient to hold more fish biomass than was in any of the tanks, even when the fish were fully mature. It appears that behavioral interactions may limit the number of individual fish, not the absolute volume of the tank.

Every effort was made to provide the captive broodstock coho salmon with a tank environment (i.e., controlled temperature, high dissolved oxygen levels, a natural photoperiod, high quality food, and high water turnover) that would allow them to grow to a similar size and mature on the same schedule as their wild counterparts. However, based on the final sizes and numbers of mature fishes, both the seawater and freshwater rearing tanks either lacked one or more environmental conditions necessary for them to obtain their maximum size and to mature at the same time as the wild coho salmon, or these processes were adversely influenced by fish aggression. The temperature range that Scott Creek coho salmon inhabit once they enter the ocean is unknown, so it was assumed that their thermal preference would be similar to more northerly coho salmon. Manzer et al. (1965) found that coho in the North Pacific Ocean were captured by fishing vessels in water temperatures ranging between 5 °C - 15.9 °C. Since Scott Creek is at the southernmost part of the range for coho salmon, water temperature in the seawater tanks was kept at 12 °C ± 2 °C (Figure 2). The water temperature in the freshwater tank varied seasonally with the temperature of the creek water that supplied it, cooler in the fall and winter and warmer in the spring and summer, and ranged from a low monthly average of 8.0 °C in December 2004 to a high monthly average of 15.5 °C in August 2003 (Figure 2). All of the tanks were supplied with supplemental aeration to ensure that DO levels remained high. DO levels in the seawater rearing tanks ranged from 5.9 to 7.2 mg/l, depending on the season and temperatures of the tanks. The DO in the freshwater tanks ranged from 7 to 9 mg/l depending on the season and water temperature. The supplemental lighting over the seawater tanks was adjusted every two to three weeks to follow the natural photoperiod at the facility latitude (36° 57'N). This was done to ensure the fish received proper light cues, because coho salmon spawning cycles are regulated by photoperiod (MacQuarrie et al., 1978). The freshwater tanks were located outdoors and only received natural lighting. Both groups of captive broodstock fish were fed a high quality diet of commercially available salmon pellets and fish-based food in a gelatinous matrix that was prepared on site.

One rearing condition that may have been inadequate to allow the captive broodstock fish to grow to similar sizes as the wild coho salmon was the current velocity in the tanks. In addition, the velocity differed substantially between the seawater and freshwater tanks and may have contributed to observed differences in the growth rates. The maximum flow rate in the seawater tanks was 1.5 l/s, which created a current velocity of 0.1 m/s. The average flow rate in the freshwater tank was 10.75 l/sec, creating a current velocity of 0.4 m/s. While this difference in current velocities may seem slight, the velocity in the freshwater tank forced the age 1^+ fish to continuously swim to hold their position in the tank, whereas 1^+ fish in the seawater tanks held their position in the tank without swimming. Forced swimming may have enabled the freshwater fish to metabolize their food more efficiently and grow more rapidly. In their review of early rearing of salmonids in fish production facilities, Pennell and McLean (1996) found that exercised fish appear to grow faster, with improved feed conversion rates, than non-exercised fish.

The captive broodstock fish had highly variable growth rates. Of 154 fish, 122 (79.2%) survived to spawning age; however, 80 of the 122 (65.6%) did not grow large enough to mature and spawn. These smaller fish grew much more slowly than those that matured, but otherwise appeared healthy and had no obvious, outward signs of injury by the larger fish. MacQuarrie et al. (1978) observed a similar pattern with fish held for a photoperiod experiment and speculated that the small fish might mature as 4 year-olds. Several smaller seawater-reared females were kept an additional year in seawater to see if they would mature as 4 year-olds. The details of this experiment are not reported here. The rest of these smaller coho salmon were not held until 4 years of age but were released into local streams that historically had coho salmon populations but did not at the time they were released. These streams were previously identified as targets for coho salmon reintroduction (CDFG, 2004).

On average the seawater-reared coho salmon were smaller in length and weight than the freshwater-reared fish (Table 5). This may have been caused by differences in the two rearing environments. The freshwater-reared fish were kept in a 6.2 m diameter by 1.1 m deep pool (35 m^3) until they were almost 2 years old, when they were moved to a tank the same size (18.6 m^3) as that used for the seawater-reared broodstock fish for their entire rearing period. Thus, tank density of the freshwater-reared fish was about half that of the seawater-reared fish until the final year of maturation. However, the difference in biomass density between the seawater and freshwater tanks does not seem to be the cause of the size difference between the two groups. The freshwater-reared fish did not start to grow faster than the seawater-reared fish until after they were transferred into equivalent sized tanks (Table 4). The accelerated growth of the freshwater-reared coho salmon prior to spawning is similar to what Campbell et al. (2006) reported. This period of accelerated growth before spawning seems to be where the difference in final weight and length between the seawater- and freshwater-reared fish occurred. This differential growth between fish in the two rearing environments during this period before spawning does not have an obvious explanation, but could be due to either chemical cues in the water or differences in the behavioral interactions of these two groups of fish resulting from earlier differences in their rearing environments and/or tank densities.

Wild vs. Captive Broodstock Females

Wild female coho salmon from Scott Creek were significantly longer and heavier than the captive broodstock females. The magnitude of the size difference between the two groups was unexpected. The different rearing environments can at least partially explain this difference; wild fish had the boundless North Pacific Ocean for rearing while the captive broodstock fish were reared in 18.6 m^3 tanks. Wild and captive broodstock coho salmon females also had significant differences ($P < 0.05$) in reproductive characteristics (Table 5). The significant differences ($P < 0.05$) in the total weight of the ovaries, number of eggs per gram, and total number of eggs between the two groups is related to the size differences between them. Shapovalov and Taft (1954) found that larger wild female coho salmon returning to Scott Creek produced more eggs than smaller females. Additionally, Drucker (1972) found that the total number of eggs produced by female coho salmon from the Karluk River (Kodiak Island, Alaska, USA) was directly related to length; longer females produced more eggs than shorter females. The weight of captive broodstock females also corresponded with the number of eggs produced, with heavier females producing more eggs on average than lighter females.

There was also a significant difference ($P < 0.05$) between the groups in total number of swim-up fry (Table 5). The captive broodstock females from both groups averaged significantly fewer swim-up fry than did the wild females. It is not clear if the lower numbers of swim-up fry for the captive broodstock females was due to inadequate nutrition during rearing, the eggs not being fully mature when harvested, poor milt quality, external environmental conditions in the hatch-out jars or eye-up trays, or other unidentified factors.

Seawater- vs. Freshwater-reared Captive Broodstock Females

The seawater-reared captive broodstock females were significantly shorter ($P < 0.05$) but not significantly lighter ($P > 0.05$) than the freshwater-reared females (Table 5). Seawater-reared females had lower, but not significantly different values ($P > 0.05$), for of all reproductive characteristics except GSI than freshwater-reared females. Most of the differences between the two group's reproductive characteristics could be explained by the size difference between them; seawater-reared females were smaller and produced fewer eggs than freshwater-reared females. However, there was no obvious explanation for the differences between the two groups in the number of eyed eggs and the total number of swim-up fry. It is unclear if the low numbers of eyed eggs and swim-up fry from the seawater-reared females were due to inadequate nutrition, the eggs not being fully mature when harvested, poor milt quality, external environmental factors in the hatch-out jars and/or eye-up trays, or other unidentified factors. Allee (1981) found that coho salmon broodstock females reared in seawater had a lower percentage of eggs survive to the eyed stage than freshwater-reared females and attributed this to lower fertilization rates of the eggs from seawater-reared females.

Ovaplant-injected vs. Naturally-maturing Captive Broodstock Females

Captive broodstock females from both rearing environments that were not maturing at the same rate as the wild coho salmon or the majority of the captive broodstock females were treated with Ovaplant to facilitate final egg maturation and to synchronize their spawning, thus maximizing the number of potential spawning partners in the breeding matrix. Ovaplant successfully synchronized the egg maturation schedule for both seawater- and freshwater-reared females. The average number of days to spawning following treatment with Ovaplant for the seawater- and freshwater-reared females was 17 days and 18 days, respectively (Table 8), which allowed spawning to end by mid March. In contrast, the wild fish and naturally-maturing captive broodstock females finished spawning by early February and late February, respectively. Eggs from the Ovaplant-injected females looked normal and appeared to fertilize well. However, after fertilization and prior to the eyed egg stage, development stopped for the majority of these eggs and they died. It is possible that the majority of these eggs were not fertilized. There was also another egg mortality event between the eyed egg stage and hatch-out. Upon a review of the data collected during the spawning season, it was apparent that both groups of females may have been treated with Ovaplant prematurely. Ovaplant is supposed to be injected into the females when their eggs are in the final stages of maturation and they are showing secondary sexual characteristics (Powell et al., 1998). It now appears that the eggs in most of the females were not in the final stages of maturation when injected, as many of the females treated with Ovaplant were not showing any secondary sexual characteristics, such as color change or softening of the belly.

The Ovaplant-injected females had the worst reproductive characteristics of any of the groups. However, without the Ovaplant, the seven females treated would likely not have spawned at all or would have matured so far out of synchrony with the wild and naturally-maturing captive fish that they would have had few potential spawning partners. If allowed to mature naturally, their progeny would also have had two to three months less than the other juveniles to grow before smolting the following year. Overall, Ovaplant is potentially a useful tool for synchronizing maturation of captive broodstock fish, but more investigation and experimentation is needed to optimize use of this treatment.

Genetic broodstock management

The captive broodstock program successfully employed a novel method for the genetic management of spawning that had as its objective the reduction of inbreeding due to mating between siblings and other close relatives. The genetic broodstock management technique employed molecular genetic data from 18 microsatellite loci to estimate the pairwise relationships between all pairs of potential mates and identify siblings and other close relatives. Such potential matings were then avoided, as they would have resulted in extreme inbreeding and consequent loss of fitness. All other potential matings were then sorted by ranking all remaining males by ascending degree of relatedness to each individual female, with the multiple males mated with each female drawn from the top of each female's ranked list. This mating scheme not only avoids most inbreeding but also maximizes the retention of genetic diversity for the coho salmon broodstock and the recipient population in Scott Creek and nearby streams. Another novel aspect of the genetic broodstock management methodology was the integration of stream-captured adult salmon into the hatchery breeding scheme through rapid genotyping of returning fish and dynamic construction of breeding/spawning matrices on a weekly basis. This allowed consideration of both captive broodstock and ocean-going fish as potential mates for one another, so as to minimize the selection of related mates and maximize genetic diversity in the offspring.

It was not possible to meet our stated goal of spawning 30 females with 45 males because there were initially only 33 males available to spawn with 32 females. In addition to having fewer males than was optimal to begin the spawning season, three males died in the pre-spawn holding tank before they were producing milt, and two other males never produced milt. Because there were only 28 viable males available in the entire spawning season, 10 males were used more than four times each. The males spawned more than four times each were generally the males that were still in good physical condition and producing milt at the end of the spawning season. If this situation is repeated in the future, we will keep all males in the pre-spawn holding tank until all females have been spawned and/or utilize cryopreserved milt to ensure that there is a sufficient number of unrelated males available to spawn with each female, without over-representing particular males.

CONCLUSIONS

Overall, the southern coho salmon captive broodstock program collaboratively established by NMFS scientists in Santa Cruz and the MBSTP was successfully initiated. Coho salmon were chosen as juveniles, reared to sexual maturity in two different environments, seawater and freshwater, and successfully spawned using a genetic breeding/spawning matrix to minimize inbreeding and maximize the genetic diversity of the progeny. Improved rearing techniques in the coming years should allow: 1) production of captive broodstock fish closer in size to wild fish, 2) reduction of adverse social interactions in the tanks, 3) a better survival rate of captive broodstock fish reared in seawater, 4) production of more eggs of better quality for each female, 5) better survival of eggs to "swim up" in both rearing environments, and 6) further reductions in inbreeding through more balanced representation of males in the progeny generation.

ACKNOWLEDGMENTS

We thank Amelia Timbers and Erin Martin for their assistance with all aspects of daily husbandry and spawning. David Streig, the Monterey Bay Salmon and Trout Project's Kingfisher Flat Genetic Conservation Fish Facility manager, provided advice and assistance in rearing and was responsible for the spawning of the coho salmon. We also thank Sean Hayes, Morgan Bond, Chad Hanson, Susan Sogard, Jeff Harding, and Arnold Ammann for assistance in capturing wild coho salmon from Scott Creek and assisting with PIT tag injection. Joe Anderson, Scott Blankenship, Cheryl Dean, Andy Martinez, Tasha Sturm and Elisha Wood-Charlson are acknowledged for their valuable assistance with the genetic data collection. Rob Schick provided the coho salmon ESU map.

FEDERAL DISCLAIMER

The National Marine Fisheries Service (NMFS) does not approve, recommend, or endorse any proprietary product or proprietary material mentioned in this publication. No reference shall be made to NMFS, or to this publication furnished by NMFS, in any advertising or sales promotion which would indicate or imply that NMFS approves, recommends, or endorses any proprietary product or proprietary material mentioned herein, or which has as its purpose an intent to cause directly or indirectly the advertised product to be used or purchased because of this NMFS publication.

REFERENCES

Allee, B. J. 1981. The status of saltwater maturation of coho salmon (*Oncorhynchus kisutch*) at Oregon Aqua-Foods, Inc. Terry Nosho (ed.), Salmonid Broodstock Maturation: Proceedings of workshops (Seattle, Washington, May 20-22, 1980 and March 11, 1981). University of Washington Sea Grant, Seattle, Washington.

Banks, M.A., M.S. Blouin, B.A. Baldwin, V.K. Rashbrook, H.A. Fitzgerald, S.M. Blankenship and D. Hedgecock. 1999. Isolation and inheritance of novel microsatellites in Chinook Salmon (*Oncorhynchus tshawytscha*). Journal of Heredity 90: 281-288.

Beacham, T.D., L. Margolis, and R.J. Nelson. 1998. A comparison of methods of stock identification for sockeye salmon (*Oncorhynchus nerka*) in Barkley Sound, British Columbia. North Pacific Anadromous Fish Commission Bulletin 1: 227-239.

Blackburn, J. and W.C. Clarke. 1990. Lack of density effect on growth and smolt quality in zero-age coho salmon. Aquacultural Engineering 9: 121-130.

Burgner, R.L. 1980. Some features of ocean migrations and timing of Pacific salmon. Pages 153-164. In: W.J. McNeil and D.C. Himsworth (eds.). Salmonid ecosystems of the North Pacific. Oregon State University Press, Corvallis, OR.

California Department of Fish and Game. (2004). Recovery strategy for California coho salmon. Report to the California Fish and Game Commission. Species Recovery Strategy 2004-1. 594 p.

Campbell, B., B.R. Beckman, W.T. Fairgrieve, J.T. Dickey, and P. Swanson. 2006. Reproductive investment and growth history in female coho salmon. Transactions of the American Fisheries Society 135: 164-173.

Condrey, M.J. and P. Bentzen. 1998. Characterization of coastal cutthroat trout (*Oncorhynchus clarki clarki*) microsatellites and their conservation in other salmonids. Molecular Ecology 7: 787-789.

deFromentel C.C., F. Pakdel, A. Chapus, C. Baney, P. May, and T. Soussi. 1992. Rainbow trout p53: cDNA cloning and biochemical characterization. Gene 112: 241-245.

Drucker, B. 1972. Some life history characteristics of coho salmon of Karluk River system, Kodiak Island, Alaska. Fisheries Bulletin 70:79-94.

Ellis, T., B. North, A.P. Scott, N.R. Bromage, M. Porter, and D. Gadd. 2002. The relationships between stocking density and welfare in farmed rainbow trout. Journal of Fish Biology 61:493-531.

Fagerlund, U.H., J.R. McBride, and E.T. Stone. 1981. Stress-related effects of hatchery rearing density on coho salmon. Transactions of the American Fisheries Society 110:644-649.

Federal Register. 1996. Final Rule. Endangered and threatened species; Threatened status for Central California Coast coho salmon evolutionarily significant unit (ESU). October 31, 1996. 61 (212): 56138-56149.

Federal Register. 2005. Final Rule. Endangered and threatened species; Final listing determinations for 16 ESUs of West Coast Salmon, and final 4(d) protective regulations for threatened salmonid ESUs. June 28, 2005. 70 (123): 37160-37204.

Gribanov, V.I. 1948. The coho salmon (*Oncorhynchus kisutch* Walb.)- a biological sketch. Izv.Tikhookean. Nauchno-Issled. Inst. Rybn. Khoz. Okeanogr. 28:43-101. (Transl. from Russian: Fish Research Board Canadian Translation Services. 370)

Hayes, S.A., M.H. Bond, C.V. Hanson, and R.B. MacFarlane. 2004. Interactions between endangered wild and hatchery salmonids: can the pitfalls of artificial propagation be avoided in a small coastal stream? Journal of Fish Biology. 65(A): 101-121.

Ishida, Y., S. Ito, Y. Ueno, and J. Sakai. 1998. Seasonal growth patterns of Pacific salmon (*Oncorhynchus* spp.) in offshore waters of the North Pacific Ocean. NPAFC Bulletin. 1: 66-80.

MacQuarrie, D.W., J.R. Markert, and W.E Vanstone. 1978. Photoperiod induced off-season spawning of coho salmon (*Oncorhynchus kisutch*). Annales de Biologie Animale, Biochimie, Biophysique. 18: 1051-1058.

Manzer, J.I., T. Ishida, A.E. Peterson and M.G. Hanavan. 1965. Salmon of the North Pacific Ocean. Part V: offshore distribution of salmon. International North Pacific Fisheries Commission Bulletin. 15:452p.

McConnell S.K., P. O'Reilly, L. Hamilton, J.M. Wright, and P. Bentzen, 1995. Polymorphic microsatellite loci from Atlantic salmon (*Salmo salar)*: genetic differentiation of North American and European populations. Canadian Journal of Fisheries and Aquatic Sciences. 52: 1863-1872.

O'Reilly P.T., Hamilton L.C., McConnell S.K. and J.M. Wright. 1996. Rapid analysis of genetic variation in Atlantic salmon (*Salmo salar*) by PCR multiplexing of dinucleotide and tetranucleotide microsatellites. Canadian Journal of Fisheries and Aquatic Sciences. 53: 2292-2298.

Pennell, W. and W.E. McLean. 1996. Early Rearing. Pages 365-466 *in* W. Pennell and B.A. Barton (eds.) Principles of Salmonid Culture. Elsevier, New York, New York, USA.

Piper, R.G. 1975. A review of carrying capacity calculations for fish hatchery rearing units. Developments in Fish Culture; Bozeman Information Leaflet; U.S. Fish and Wildlife Service, 9p.

Powell, J.F.F, J. Brackett, and J.A. Battaglia. 1998. Induced and synchronized spawning of captive broodstock using Ovaplant and Ovaprim. Proceedings of the Aquaculture Association of Canada 98: 14-18.

Queller, D.C., and K.F. Goodnight. 1989. Estimating relatedness using genetic markers. Evolution 43: 258-275.

Rexroad, C.E., R.L. Coleman, W.K. Hershberger, and J. Killefer. 2002. Rapid communication: Thirty-eight polymorphic microsatellite markers for mapping in rainbow trout. Journal of Animal Sciences 80: 541-542.

Ryer, C.H. and B.L. Olla. 1996. Growth depensation and aggression in laboratory reared coho salmon: the effect of food distribution and ration size. Journal of Fish Biology 48: 686-694.

Scribner, K.T., J.R. Gust, and R.L. Fields. 1996. Isolation and characterization of novel salmon microsatellite loci: cross-species amplification and population genetic applications. Canadian Journal of Fisheries and Aquatic Sciences 53: 833-841.

Shapovalov, L. and A.C. Taft. 1954. The life histories of the steelhead rainbow trout (*Salmo gairdneri gairdneri*) and silver salmon (*Oncorhynchus kisutch*). California Department of Fish and Game, Fish Bulletin 98: 1-375.

Smith, C.T., B.F. Koop, and R.J. Nelson. 1998. Isolation and characterization of coho salmon (*Oncorhynchus kisutch*) microsatellites and their use in other salmonids. Molecular Ecology 7: 1614-1616.

Soudakevicz, T. 1874. Report on the progress of pisciculture in Russia. Report of the U.S. Fish Commissioner of Fish and Fisheries 2: 493-513.

Tyler, A.V., C.O. Swanton, and B.C. McIntosh. 2001. Feeding Ecology of Maturing Sockeye Salmon (*Oncorhynchus nerka*) in Nearshore Waters of the Kodiak Archipelago. Final Report, OCS Study MMS 2110-059. 34p.

Waples, R. S. 1991. Pacific salmon, *Oncorhynchus* spp., and the definition of “species” under the Endangered Species Act. Marine Fisheries Review 53: 11-22.

Weitkamp, L.A., T.C. Wainwright, G. J. Bryant, G. B. Milner, D. J. Teel, R. G. Kope, and R. S. Waples. 1995. Status Review of Coho Salmon from Washington, Oregon, and California. U.S. Dept. of Commerce, NOAA Technical Memorandum. NMFS-NWFSC-24, 258 p.

Williamson, K.S., J.F. Cordes, and B. May. 2002. Characterization of microsatellite loci in Chinook salmon (*Oncorhynchus tshawytscha*) and cross-species amplification in other salmonids. Molecular Ecology Notes 2: 17-19.

Year	Run Designation	Estimated Spawning Run	Comments
2002	"A"	400 adults (range: 300 – 500)	Estimate is a "best guess" based on visual observations of fish in the creek
2003	"B"	15 adults (range: 10 – 25)	Estimate is a "best guess" based on visual observations of fish in the creek
2004	"C"	272 adults	Estimate is based on a quantitative weir capture with a capture efficiency correction factor applied
2005	"A"	321 adults	Estimate is based on a quantitative weir capture with a capture efficiency correction factor applied

Table 1. Estimated sizes of Scott Creek coho salmon spawning runs from 2002 to 2005. The estimated spawning run sizes for 2002 and 2003 were "best guesses" from visual observations. The 2004 and 2005 estimates were based on tag-recapture of fish captured in a weir trap operated by NMFS personnel and released upstream. These numbers are probably underestimates because coho typically migrate upstream during extreme high flows that submerge the weir and render it inoperable. Data from S. Hayes (unpublished).

Locus	Size Range (bp)	# Alleles	Reference
Ocl 8*	97-155	25	Condrey and Bentzen 1998
Oki 1	87-155	18	Smith et al. 1998
Oki 13*	86-104	7	Smith et al. 1998
Omm 1058	176-300	30	Rexroad et al. 2002
Omm 1080	201-503	76	Rexroad et al. 2002
Omm 1116*	102-132	5	Rexroad et al. 2002
One 11b*	103-117	5	Scribner et al. 1996
One 13*	149-191	19	Scribner et al. 1996
Ots 103*	73-269	42	Beacham et al. 1998
Ots 1b*	224-248	7	Banks et al. 1999
Ots G3	134-150	5	Williamson et al. 2001
Ots G422b*	245-481	69	Williamson et al. 2001
Ots G68*	155-383	54	Williamson et al. 2001
Ots G78b	155/173-329	38	Williamson et al. 2001
Ots G83b*	92-506	97	Williamson et al. 2001
P53*	158-216	17	de Fromentel et al. 1992
Ssa 14*	132-166	6	McConnell et al. 1995
Ssa 85	103-135	6	O'Reilly et al. 1996

Table 2. Microsatellite loci used to genotype coho salmon in this project. bp = base pairs.
* = loci used for broodstock selection.

SCOTT CREEK COHO BREEDING MATRIX, WEEK 1
(Continued on next page)

SAMPLES COLLECTED BY 3 JAN 2005

FEMALES LISTED ALONG TOP, MALES RANKED FROM BEST TO WORST MATE FOR EACH FEMALE

FIRST 6 FEMALES ARE WILD CAUGHT (FLOY TAG), REST ARE BROODSTOCK (SEX_LAST 5 DIGITS OF PIT TAG)

RED: AVOID THESE MATINGS IF POSSIBLE, USE ONLY AS LAST RESORT (RXY > 0.25)

PINK: WILD FEMALE BLUE: WILD MALE ALL OTHERS: BROODSTOCK

	F	E	M	A	L	E	S	
	Pink390	**PR947**	**PW1026**	**PW1027**	**PW1053**	**PW1054**	**F_2F2D88**	**F_2F9C17**
BEST MATE	M_81D606	M_302CA5	BW1115	M_302CA5	M_822D5C	BW1115	M_818513	BW1114
	M_8288B1	M_81D662	M_81D606	BW1115	M_81CFFC	M_81D6EE	M_2F9DC6	M_2FA1E0
	BW1115	BW1115	M_302CA5	M_829DF1	M_3032C0	M_81D662	M_81D662	M_2F9DC6
	M_81D6EE	M_81D606	BW1162	M_81CFFC	M_8288B1	M_81D606	M_2F15E4	M_3AF886
	M_302CA5	M_81CFFC	M_3BF453	M_2F9435	M_2F00AF	M_302CA5	BW1114	BW1162
	M_81D662	BW1114	M_812236	M_8280A6	M_301505	M_81CFFC	M_3032C0	M_826B33
	Bw1153	M_2FA1E0	M_2F1C11	M_8288B1	M_3B0B3D	M_829DF1	M_3BF453	M_81CFFC
	M_81C7FD	M_829DF1	M_2F9435	M_81D6EE	M_2F1C11	M_30425F	M_81D6EE	M_3032C0
M	M_301505	M_8288B1	M_823E5D	M_81D606	Bw1153	M_301505	M_8280A6	M_818513
A	M_2F9435	M_2F15E4	M_8265D8	M_30425F	M_8280A6	M_2F1C11	M_818412	M_8175D1
L	M_2F1C11	M_81D6EE	M_81D662	M_8175D1	M_3B0CEE	M_8265D8	Bw1160	M_81D606
E	M_8175D1	M_822D5C	M_8175D1	M_3032C0	M_3BF453	M_821F00	M_81CFFC	M_3B0CEE
S	M_3032C0	M_2F9435	M_30425F	M_81C7FD	M_81C7FD	M_8288B1	M_823E5D	M_30425F
	M_3B0B3D	M_81C7FD	M_2F15E4	M_301505	M_823E5D	M_2F9435	M_3AF886	Bw1153
	M_81CFFC	M_8175D1	M_3AF886	Bw1161	M_8175D1	M_2F15E4	M_813728	M_8288B1
	BW1162	M_3B0B3D	M_2F20C2	M_81D662	Bw1161	BW1114	M_3B0CEE	M_823E5D
	M_2F00AF	M_3032C0	M_826B33	M_2F9DC6	M_2F20C2	Bw1153	M_2F1C11	M_302CA5

	M_822D5C	M_301505	M_3B0CEE	M_8265D8	M_81D662	M_812236	Bw1161	M_829DF1
	M_818412	Bw1153	Bw1153	M_2F20C2	M_2F9DC6	Bw1161	BW1162	Bw1161
	M_829DF1	M_2F1C11	M_818513	BW1114	M_826B33	M_81C7FD	M_826B33	M_2F1C11
	M_3AF886	Bw1161	M_3032C0	M_3B0B3D	M_8265D8	M_8175D1	M_2F20C2	M_821F00
	M_8280A6	M_8265D8	M_81C7FD	M_2F00AF	M_818513	M_8280A6	M_301505	M_2F9435
	M_2FA1E0	M_8280A6	M_829DF1	M_821F00	M_302CA5	M_818412	M_821F00	M_81C7FD
	M_813728	M_3BF453	M_821F00	Bw1153	M_821F00	M_813728	Bw1153	M_818412
	M_818513	M_30425F	M_81D6EE	M_822D5C	M_818412	M_2FA1E0	M_81C7FD	M_81D6EE
	M_8265D8	BW1162	BW1114	M_2F1C11	M_2F9435	M_3B0B3D	M_8288B1	Bw1160
	BW1114	M_2F9DC6	M_2FA1E0	M_2F15E4	M_813728	M_2F20C2	M_30425F	M_2F15E4
	M_812236	M_2F00AF	M_3B0B3D	M_3AF886	M_30425F	M_2F00AF	M_822D5C	M_813728
	M_3BF453	M_812236	M_8288B1	M_3B0CEE	BW1115	M_3BF453	M_3B0B3D	M_3B0B3D
	M_821F00	Bw1160	M_8280A6	M_812236	M_812236	M_826B33	M_8265D8	M_2F20C2
	M_823E5D	M_813728	M_822D5C	M_813728	M_81D606	M_3032C0	M_302CA5	M_812236
	M_3B0CEE	M_821F00	Bw1161	M_818412	Bw1160	Bw1160	M_8175D1	M_8280A6
	M_30425F	M_2F20C2	Bw1160	M_2FA1E0	M_81D6EE	**M_822D5C**	M_2F00AF	M_81D662
	Bw1161	M_818412	M_2F00AF	M_826B33	BW1162	**BW1162**	M_81D606	M_8265D8
	M_2F15E4	M_3AF886	M_813728	M_823E5D	M_2FA1E0	**M_3AF886**	M_2F9435	M_301505
	M_826B33	**M_818513**	**M_818412**	**M_3BF453**	M_3AF886	**M_3B0CEE**	M_2FA1E0	M_822D5C
	M_2F9DC6	**M_826B33**	**M_81CFFC**	**M_818513**	BW1114	**M_823E5D**	M_812236	M_2F00AF
	Bw1160	**M_3B0CEE**	**M_301505**	**BW1162**	M_829DF1	**M_818513**	M_829DF1	**BW1115**
WORST MATE	**M_2F20C2**	**M_823E5D**	**M_2F9DC6**	**Bw1160**	M_2F15E4	**M_2F9DC6**	**BW1115**	**M_3BF453**

Table 3. Coho spawning matrix for January 7, 2005. Each column is for a single female. Males, listed below each female, are ranked by their genetic relatedness to the female with the most unrelated males at the top of the column (best choice to spawn with). Wild males are in the shaded cells and the most related males are in bold at the bottom of the column (worst choice to spawn with).

Location	Date	N	Average Fork Length (FL) (mm)	Average Weight (Wt) (g)	Average FL gain mm/Day since last measurement	Average Wt gain g/day since last measurement	Average Condition Factor (K)
Tank 1 SCL	10-Dec-02	53	126.96	27.72			1.35
Tank 4 SCL	10-Dec-02	55	132.74	27.88			1.19
Hatchery	10-Dec-02	47	127.85	26.70			1.27
Tank 1 SCL	2-Apr-03	52	163.55	59.53	0.32	0.28	1.36
Tank 4 SCL	2-Apr-03	56	167.25	60.16	0.30	0.28	1.28
Hatchery	3-Apr-03	47	164.97	59.91	0.33	0.29	1.33
Tank 1 SCL	11-Jun-03	51	184.58	84.29	0.18	0.50	1.34
Tank 4 SCL	11-Jun-03	56	181.26	76.98	0.05	0.18	1.29
Hatchery	12-Jun-03	44	186.77	82.10	0.33	0.55	1.26
Tank 1 SCL	29-Jul-03	50	203.38	128.22	0.39	0.91	1.52
Tank 4 SCL	29-Jul-03	55	198.05	107.74	0.36	0.66	1.38
Hatchery	13-Aug-03	44	204.75	120.86	0.28	0.60	1.40
Tank 1 SCL	20-Oct-03	49	222.46	174.12	0.22	0.55	1.58
Tank 4 SCL	20-Oct-03	55	227.20	160.64	0.35	0.63	1.36
Hatchery	8-Oct-03	44	217.81	142.63	0.23	0.38	1.38
Tank 1 SCL	21-Jan-04	42	260.38	254.14	0.40	0.86	1.43
Tank 4 SCL	21-Jan-04	25*	275.60	224.36	0.52	0.68	1.07
Hatchery	22-Jan-04	44	268.84	259.18	0.48	1.09	1.33
Tank 1 SCL	31-Mar-04	41	278.12	305.09	0.25	0.72	1.41
Tank 4 SCL	31-Mar-04	19*	269.36	258.94	-0.08	0.18	1.32
Hatchery	15-Apr-04	44	300.22	333.86	0.37	0.88	1.23
Tank 1 SCL	3-Jun-05	36	302.91	405.52	0.39	1.59	1.45
Tank 4 SCL	3-Jun-05	40	299.62	383.57	0.47	2.31	1.42
Hatchery	16-Jun-04	49	331.28	425.87	0.50	1.48	1.17
Tank 1 SCL	14-Dec-04	32	357.03	710.68	0.27	1.57	1.56
Tank 4 SCL	14-Dec-04	37	363.72	767.13	0.33	1.97	1.59
Hatchery	16-Dec-04	48	427.77	1263.91	0.52	4.57	1.61

Table 4. Size, growth, and condition data from the periodic length and weight measurements conducted on all the 2002 BY captive broodstock, including those not used for spawning. * Not all fish in the tank were measured on this day so the row averages are not accurate representations of the true averages for the tank.

Female Coho Rearing Environment (N)	FL (mm)	Wt (g)	Weight of eggs (g)	GSI	Number of eggs/g	Total Number of eggs	Number of eyed eggs	Number of eggs hatched
	Mean values for each category (SE)							
Wild (20)	629.8[a] (8.1)	3250.0[a] (121.8)	708.3[a] (45.1)	22.0[a] (1.3)	3.0[a] (0.1)	2005.0[a] (107.1)	1433.0[a] (132.7)	1208.5[a] (133.8)
Freshwater (7,6)*	509.4*[b] (14.1)	2076.3*[b] (205.7)	464.5[b] (55.1)	23.6[a] (2.4)	4.0[b] (0.6)	1717.1[a,b] (140.5)	1006.3[a] (211.7)	485.1[b] (133.9)
Saltwater (5)	436.0[c] (23.4)	1484.2[b] (287.8)	314.7[b] (13.8)	26.7[a] (7.7)	4.7[b] (0.1)	1463.2[b] (67.2)	755.6[a] (248.9)	229.6[b] (105.8)

Table 5. Mean values (±SE) for size and reproductive characteristics for the 2002 Brood Year wild and captive broodstock female coho salmon spawned at the Kingfisher Flat Hatchery from January –March 2005. SE in parentheses. * One captive broodstock female died before spawning and was only included in the length and weight analysis

Category of Coho Salmon (N	Length (mm)	Weight (g)	Mass of eggs (g)	GSI	No. Eggs per gram	Total No. of eggs	No. Eyed Eggs	Total # of eggs hatched
	Average Measurement for Each Group (Standard Error)							
Naturally-maturing Captive Broodstock (5)	470.00 (33.27)[a]	1805.00 (314.27)[a]	448.49 (69.83)[a]	29.68 (7.47)[a]	3.94 (0.56)[a]	1621.60 (155.83)[a]	1312.00 (138.78)[a]	576.20 (50.67)[a]
Ovaplant Injected Captive Broodstock (7,6)**	488.12 (16.62)[a]	1875.75 (235.78)[a]	368.95 (43.82)[a]	21.46 (1.83)[a]	4.55 (0.41)[a]	1604.00 (121.57)[a]	608.85 (187.47)[b]	237.57 (136.43)[a]

Table 6. Mean values for size and reproductive characteristics for the naturally maturing and Ovaplant injected coho salmon spawned at the Kingfisher Flat Genetic Conservation Hatchery in 2002. Different superscript letters in a column indicate significant differences ($P < 0.05$) between those groups using a Students T-Test.

Week# >	1	3	3	4	4	4	4	4	5	5	5
Spawn Date >	1/6/05	1/17/05	1/17/05	1/27/05	1/27/05	1/27/05	1/27/05	1/27/05	1/31/05	2/3/05	2/3/05
Female >	**PW1054**	**Pink390**	**PW1028**	*PR0898*	*PR0899*	**PW1055**	**PW1098**	**PW2378**	**PW1059**	**PW1062**	**PW2379**
Male 1	**BW1114**	**BW2001**	**BW1115**	**BW2002**	**BW2001**	**BW1161**	**BW2126**	**BW2126**	BR0980	**BW2003**	**BW1159**
Male 2	**BW1115**	**BW1115**	**BW1161**	BR1000	**BW2130**	**BW2126**	**BW2128**	**BW2128**	BR1000	**BW2132**	**BW2003**
Male 3	**BW1161**	**BW2002**	**BW2001**	**BW2128**	**BW2131**	**BW2128**	**BW2130**	**BW2130**	BR1017	BR0987	**BW2132**
Male 4	**BW2002**	BR0980	BR0980	BR1017	BR1017	**BW2131**	BR1000	**BW2131**	**BW2134**	BR1018	BR0987

Week# >	6	6	6	6	6	6	6	6	7	7	7
Spawn Date >	2/10/05	2/10/05	2/10/05	2/10/05	2/10/05	2/10/05	2/10/05	2/10/05	2/14/05	2/14/05	2/14/05
Female >	PR0896	PR0908	PR0912	PR0917	PR0920	PR0924	**PW2377**	**PW2382**	PR0905	PR0916	PR0948
Male 1	BR0990	BR0988	BR0988	BR0977	BR0978	BR0978	BR0987	BR0987	BR0977	BR0977	BR0977
Male 2	BR1018	**BW1155**	BR0993	BR0978	BR0990	BR0990	**BW1155**	BR0988	BR1018	BR0985	BR0985
Male 3	**BW2133**	**BW2132**	BR1021	BR0988	BR0993	BR1021	**BW2132**	**BW2132**	**BW2006**	BR1018	**BW1155**
Male 4	**BW2134**	**BW2134**	**BW1155**	BR0993	BR1021	**BW2133**	**BW2134**	**BW2133**	**BW2022**	**BW2022**	**BW2006**

Week# >	7	7	7	7	7	7	7	8	8	10
Spawn Date >	2/14/05	2/14/05	2/17/05	2/17/05	2/17/05	2/17/05	2/17/05	2/22/05	2/22/05	3/7/05
Female >	**PW1076**	**PW2380**	*PR0894*	PR0904	*PR0943*	**PW2376**	**PW2381**	*PR0897*	PR0901	PR0895
Male 1	**BW1155**	**BW1155**	BR1021	BR0991	BR0978	BR0985	BR0978	**BW1119**	**BW1119**	**BW2135**
Male 2	**BW2006**	**BW2006**	**BW1118**	BR1021	BR0985	BR1021	**BW1118**	BR0990	BR0990	BR1018
Male 3	**BW2022**	**BW2022**	**BW1119**	**BW1118**	BR0991	**BW1118**	**BW1119**	BR0991	BR0991	BR0987
Male 4	**BW2134**	**BW2134**	**BW1155**	**BW1119**	BR0998	**BW1119**	**BW1155**	BR0998	BR0998	BR0977

KEY:

Bold: wild fish, stream caught spawning return (PW and BW prefixes)

Shaded: not genotyped and/or spawned without genetic data or relatedness information

Boxed/italic wild-caught hatchery spawning return

Table 7. Actual crosses of coho salmon spawned in winter 2004/2005 as part of southern coho salmon captive broodstock program.

Female Type	FL (mm)	Wt (g)	Days to Spawning	Mass of Eggs (g)	Total No. Eggs	GSI	No. Eggs/gram	No. Eyed Eggs	No. Eggs Hatched
Freshwater	435	1200	19	289.17	1284	24.10	4.44	1074	976
Freshwater	495	1985	20	289.17	1856	14.57	6.42	0	0
Freshwater	480	1500	15	436.59	2156	29.11	4.94	980	456
Averages	470	1562	18	338.31	1765	22.59	5.27	685	477
Seawater	420	1152	17	286.33	1242	24.86	4.34	66	17
Seawater	480	2000	17	362.88	1612	18.14	4.44	288	95
Seawater	495	1579	17	317.52	1466	20.11	4.62	1202	62
Averages	465	1577	17	322.24	1440	21.04	4.47	519	58
Seawater/Freshwater	560	3100	21	601.02	1612	19.39	2.68	652	57

Table 8. Female coho salmon captive broodstock physical and spawning data for all of the 2002 brood individuals injected with Ovaplant. The female listed as Seawater/Freshwater appeared to be a precocious female and was transferred to freshwater at the hatchery after only 9 months in seawater. However, she did not mature until after another year in freshwater as a normal 3 year-old fish.

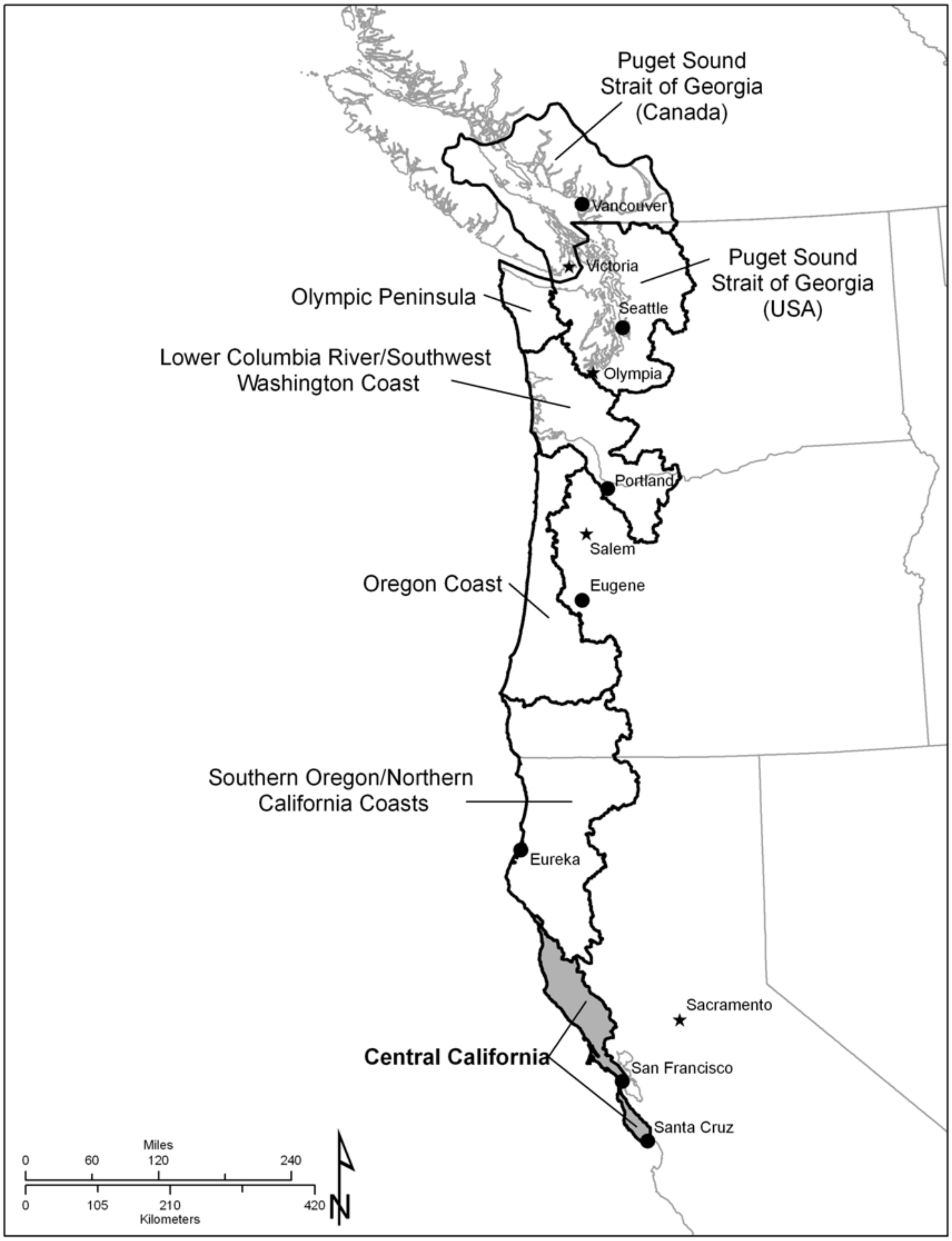

Figure 1. Evolutionarily Significant Units for all west coast coho salmon (*Oncorhynchus kisutch*). The Scott Creek population is located at the southern end of the Central California Coho ESU, the shaded area just north of Santa Cruz.

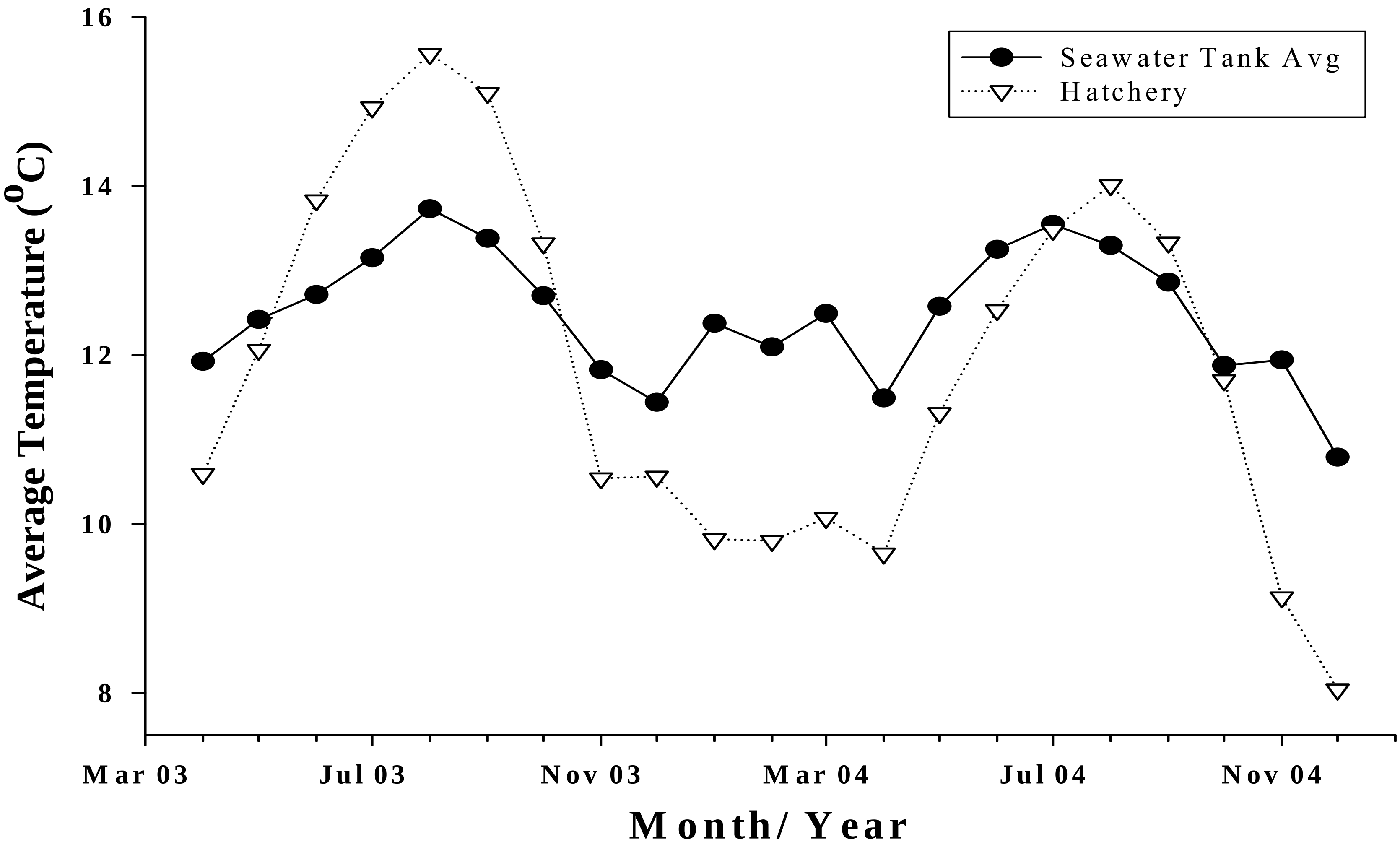

Figure 2. Average monthly water temperatures of seawater and freshwater tanks over the entire 2002 coho captive broodstock rearing period.

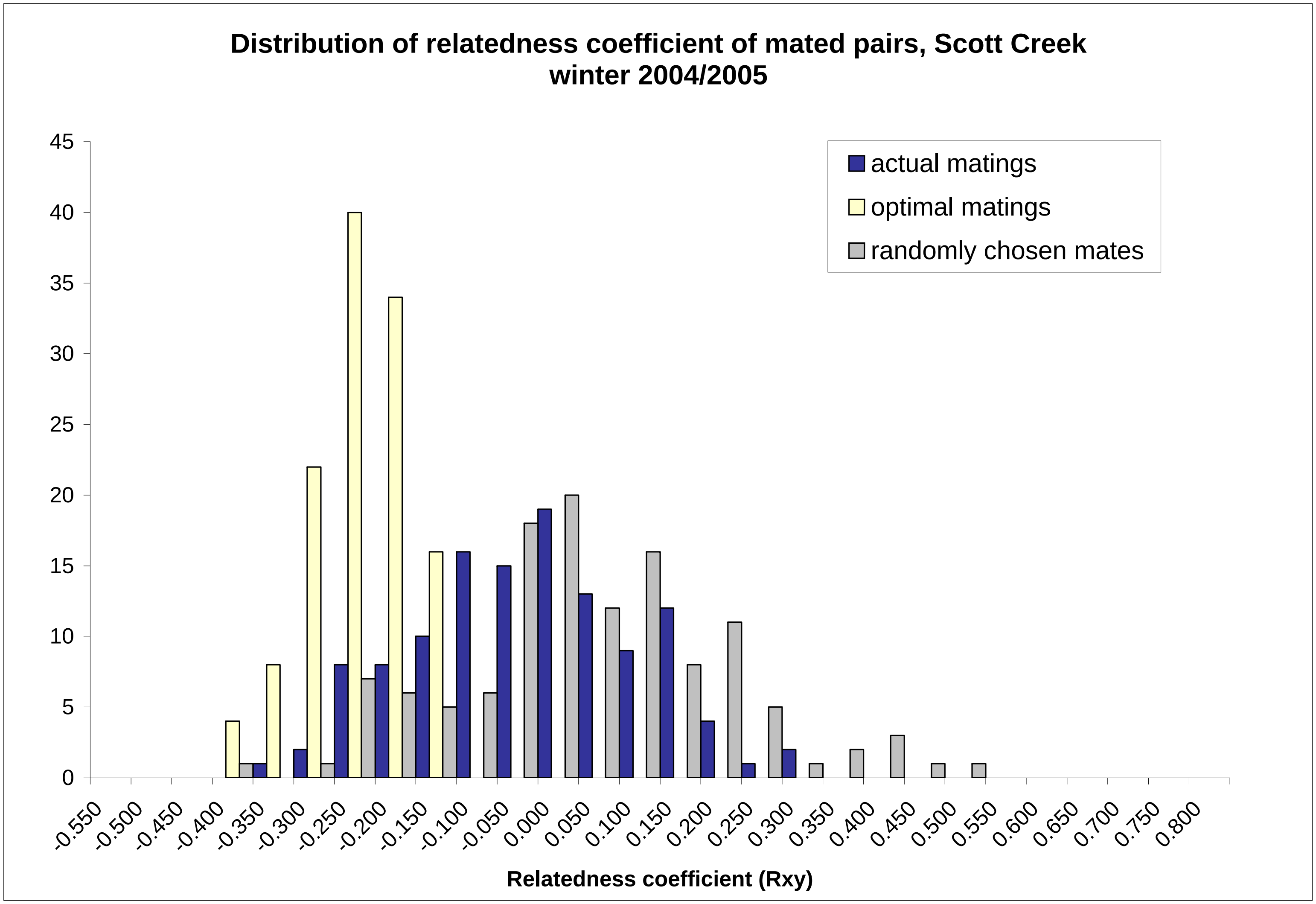

Figure 3. Distribution of pairwise values of the relatedness coefficient (R_{xy}) for all coho salmon available for spawning as part of the captive broodstock program in the winter of 2004/05. Actual matings (blue bars), potential matings with optimal use of genetic matrix (each female with four males with lowest R_{xy}) and random matings of each female with four males are all shown.

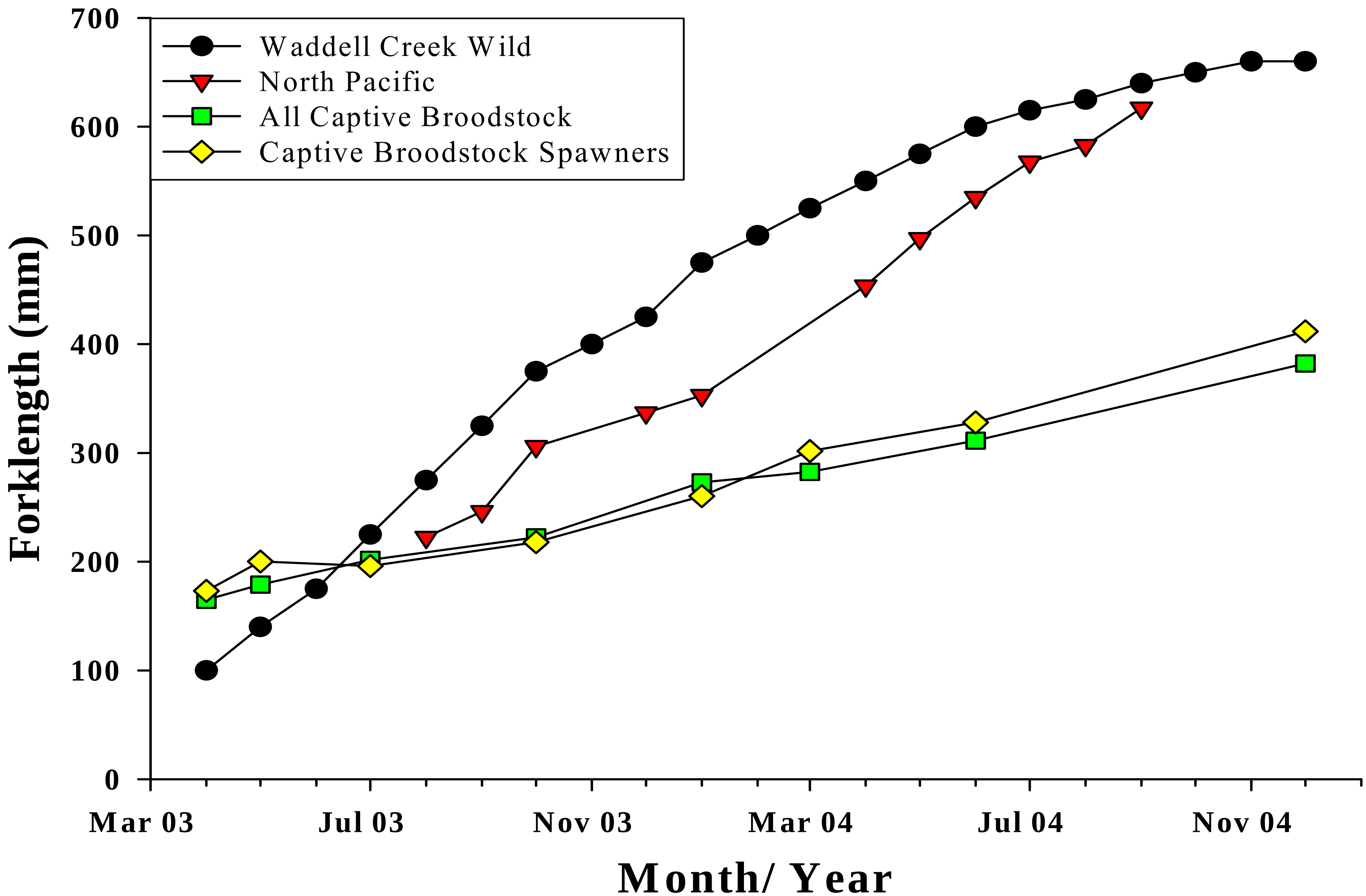

Figure 4. Comparison of average fork lengths of wild coho salmon vs. captive broodstock coho salmon at equivalent times of the year. See text for reference citations.

Appendix 1

Salmon Shed Light Timer Settings
Note: Bold entries indicate times corrected to Daylight Savings Time

Date	Sunrise	Sunset
1-Jan	7:30	5:00
26-Jan	7:30	5:30
12-Feb	7:00	5:30
28-Feb	7:00	6:00
14-Mar	6:30	6:00
28-Mar	6:00	6:30
11-Apr	**6:30**	**7:30**
26-Apr	**6:30**	**8:00**
15-May	**6:00**	**8:00**
1-Jun	**6:00**	**8:30**
21-Jun	**5:30**	**8:30**
1-Jul	**6:00**	**8:30**
28-Jul	**6:00**	**8:00**
14-Aug	**6:30**	**8:00**
31-Aug	**6:30**	**7:30**
12-Sep	**7:00**	**7:30**
30-Sep	**7:00**	**7:00**
14-Oct	**7:00**	**6:30**
31-Oct	6:30	5:30
14-Nov	6:30	5:00
30-Nov	7:00	5:00
15-Dec	7:30	5:00

Appendix 2

GELATIN FOOD RECIPE
BIG BATCH

This recipe will make enough food for 4, one-gallon containers.
You need to use the Waring Industrial Blender to make a Big Batch of gel food.

INGREDIENTS:

568 g herring, sardines, or anchovies
28.4 g freeze dried krill (if fresh krill is used, assume 90% of the initial weight is water and use 284g)
284 g squid
864 g Biodiet Salmon Pellets (use smallest or oldest pellets available)
50 ml Phoenix amino acid solution
590 g powdered gelatin
2200 ml of hot tap water (**use less water if fresh krill is used**)
2 vitamin tablets
20 g freeze dried cyclopeez
10 g freeze dried spirulina

PREPARATION:

1. Thaw frozen ingredients before use. Pull them from the freezer two days in advance so they will thaw. The morning you make the gel food let all ingredients warm up on the counter for at least two hours. Cold ingredients do not allow the gelatin to set properly.
2. Place half of the water into each saucepan and heat using the hotplate (set on high) and bring the water to a slow boil. This takes awhile so continue on with the next steps.
3. In the blender mix the herring, krill, squid, amino fuel, vitamins, and some water (200 ml) from one of the sauce pans and blend until smooth.
4. Add one liter of the boiling water and mix
5. With the blender running slowly add the Biodiet pellets.
7. Repeat Step 4.
8. With the blender on high slowly add the gelatin blend until smooth.
9. Pour equally into 4 of the food containers and immediately place in the freezer.
10 Repeat steps 2 through 9
10. After the gel food sets (24 hrs) thaw it in the refrigerator (24 hrs,) then chop it up into appropriate sized pieces for the fish
11. Put into ziplock bags and keep in freezer until ready for use.

Note: if you use fresh or frozen krill reduce the amount of water to about 1800 to 2000 ml.

Appendix 3

Coho Salmon Milt Cryopreservation and Activation Solution Recipes

Milt Cryopreservation

81 ml distilled water, divided
9 ml DMSO
10 ml chicken egg yolk at room tempertature
5.4 g dextrose

In a container add 40 ml distilled water, add dextrose and mix until dextrose is dissolved. Add DMSO and egg yolk, and 41 ml of distilled water and mix well. Store for up to 1 week in a refrigerator.

Milt Activation Solution

1 L distilled water, divided
9.0 g NaCl
1.21 g Tris base buffer
1.5g glycine
0.9 g theophyline

In a 1-l container add about 600 ml distilled water add all dry contents and then put container on a heated stirring plate and warm and mix solution until all solids dissolve, about 10-15 min. Let solution cool a little then add enough of the reserved distilled water to make 1 liter of solution. Solution can be stored for 1 week in a refrigerator. If solution becomes cloudy during storage, discard it.

SCOTT CREEK COHO BREEDING MATRIX, WEEK 1 **DATE: 7 JAN 2005**

SAMPLES COLLECTED BY 3 JAN 2005

FEMALES LISTED ALONG TOP, MALES RANKED FROM BEST TO WORST MATE FOR EACH FEMALE

FIRST 6 FEMALES ARE WILD CAUGHT (FLOY TAG), REST ARE BROODSTOCK (SEX_LAST 5 DIGITS OF PIT TAG)

SHADED: AVOID THESE MATINGS IF POSSIBLE, USE ONLY AS LAST RESORT (RXY>0.25)

BOLD: WILD FISH, STREAM CAPTURED SPAWNING RETURN ALL OTHERS:CAPTIVE BROODSTOCK

F E M A L E S

	Pink390	**PR947**	**PW1026**	**PW1027**	**PW1053**	**PW1054**	F_2F2D88	F_2F9C17	F_3019C6	F_301C7E	F_301D28	F_302382	F_30343C	F_303C71	F_3AF9A1	F_3B01D4
BEST	M_81D606	M_302CA5	**BW1115**	M_302CA5	M_822D5C	**BW1115**	M_818513	**BW1114**	M_3BF453	M_81D606	**BW1115**	M_8175D1	M_3BF453	M_2F9435	**BW1114**	**BW1114**
MATE	M_8288B1	M_81D662	M_81D606	**BW1115**	M_81CFFC	M_81D6EE	M_2F9DC6	M_2FA1E0	M_2F00AF	M_3B0CEE	M_2F9435	M_2F1C11	M_2F15E4	M_81D606	M_3032C0	M_81CFFC
	BW1115	**BW1115**	M_302CA5	M_829DF1	M_3032C0	M_81D662	M_81D662	M_2F9DC6	M_823E5D	M_2F9435	M_829DF1	M_2FA1E0	M_821F00	M_302CA5	M_2F15E4	M_301505
	M_81D6EE	M_81D606	**BW1162**	M_81CFFC	M_8288B1	M_81D606	M_2F15E4	M_3AF886	M_3032C0	M_2F1C11	M_302CA5	**BW1114**	M_2F1C11	M_81D662	M_2F9DC6	M_81D6EE
	M_302CA5	M_81CFFC	M_3BF453	M_2F9435	M_2F00AF	M_302CA5	**BW1114**	**BW1162**	M_301505	M_302CA5	M_3B0CEE	M_302CA5	M_3032C0	M_821F00	M_2F00AF	M_8280A6
	M_81D662	**BW1114**	M_812236	M_8280A6	M_301505	M_81CFFC	M_3032C0	M_826B33	M_3B0B3D	M_812236	M_818513	M_81C7FD	M_81D6EE	M_81D6EE	M_818412	M_8175D1
	BW1153	M_2FA1E0	M_2F1C11	M_8288B1	M_3B0B3D	M_829DF1	M_3BF453	M_81CFFC	M_3B0CEE	M_829DF1	M_81D606	M_81D662	M_3B0CEE	M_8280A6	M_2F1C11	M_818412
	M_81C7FD	M_829DF1	M_2F9435	M_81D6EE	M_2F1C11	M_30425F	M_81D6EE	M_3032C0	M_818513	M_3BF453	M_812236	M_826B33	**BW1162**	**BW1115**	M_823E5D	M_2F1C11
M	M_301505	M_8288B1	M_823E5D	M_81D606	**BW1153**	M_301505	M_8280A6	M_818513	M_8175D1	M_30425F	M_3AF886	M_812236	M_81D662	M_2F1C11	M_826B33	M_813728
A	M_2F9435	M_2F15E4	M_8265D8	M_30425F	M_8280A6	M_2F1C11	M_818412	M_8175D1	M_818412	M_821F00	M_8288B1	M_3AF886	M_8288B1	M_3BF453	M_8265D8	M_81D662
L	M_2F1C11	M_81D6EE	M_81D662	M_8175D1	M_3B0CEE	M_8265D8	**BW1160**	M_81D606	M_813728	M_2F00AF	M_821F00	M_81CFFC	M_823E5D	M_3AF886	M_3B0CEE	M_2F9DC6
E	M_8175D1	M_822D5C	M_8175D1	M_3032C0	M_3BF453	M_821F00	M_81CFFC	M_3B0CEE	M_2FA1E0	M_2F20C2	M_3B0B3D	M_81D606	M_818513	M_8288B1	M_81CFFC	M_3BF453
S	M_3032C0	M_2F9435	M_30425F	M_81C7FD	M_81C7FD	M_8288B1	M_823E5D	M_30425F	M_822D5C	**BW1115**	M_81D6EE	**BW1162**	**BW1161**	M_2F20C2	M_8280A6	M_812236
	M_3B0B3D	M_81C7FD	M_2F15E4	M_301505	M_823E5D	M_2F9435	M_3AF886	**BW1153**	**BW1115**	M_81D662	M_3BF453	M_2F20C2	M_30425F	M_829DF1	M_818513	M_2F20C2
	M_81CFFC	M_8175D1	M_3AF886	**BW1161**	M_8175D1	M_2F15E4	M_813728	M_8288B1	M_81D606	M_8175D1	M_2F00AF	M_8280A6	M_812236	M_812236	M_30425F	M_3032C0
	BW1162	M_3B0B3D	M_2F20C2	M_81D662	**BW1161**	**BW1114**	M_3B0CEE	M_823E5D	M_81D662	M_3B0B3D	M_2F20C2	**BW1153**	**BW1114**	M_823E5D	M_2FA1E0	M_30425F
	M_2F00AF	M_3032C0	M_826B33	M_2F9DC6	M_2F20C2	**BW1153**	M_2F1C11	M_302CA5	M_2F9435	M_8288B1	M_81C7FD	M_301505	M_301505	M_3032C0	M_3B0B3D	M_826B33
	M_822D5C	M_301505	M_3B0CEE	M_8265D8	M_81D662	M_812236	**BW1161**	M_829DF1	M_8288B1	M_301505	M_81D662	**BW1160**	M_3AF886	M_3B0B3D	M_81D6EE	**BW1160**
	M_818412	**BW1153**	**BW1153**	M_2F20C2	M_2F9DC6	**BW1161**	**BW1162**	**BW1161**	M_829DF1	M_823E5D	M_8265D8	M_81D6EE	M_81D606	M_2F15E4	M_813728	**BW1153**
	M_829DF1	M_2F1C11	M_818513	**BW1114**	M_826B33	M_81C7FD	M_826B33	M_2F1C11	**BW1162**	M_3032C0	M_3032C0	**BW1115**	M_2F20C2	**BW1161**	M_822D5C	M_81C7FD
	M_3AF886	**BW1161**	M_3032C0	M_3B0B3D	M_8265D8	M_8175D1	M_2F20C2	M_821F00	M_3AF886	M_813728	M_2F1C11	M_30425F	**BW1160**	M_3B0CEE	**BW1160**	M_2FA1E0
	M_8280A6	M_8265D8	M_81C7FD	M_2F00AF	M_818513	M_8280A6	M_301505	M_2F9435	M_812236	M_818412	**BW1162**	M_2F9435	**BW1115**	M_301505	M_81C7FD	M_2F15E4
	M_2FA1E0	M_8280A6	M_829DF1	M_821F00	M_302CA5	M_818412	M_821F00	M_81C7FD	M_2F15E4	M_81C7FD	**BW1160**	M_3032C0	M_81CFFC	M_818513	M_821F00	M_821F00
	M_813728	M_3BF453	M_821F00	**BW1153**	M_821F00	M_813728	**BW1153**	M_818412	M_81C7FD	M_826B33	M_826B33	M_818513	M_8280A6	M_81C7FD	M_8288B1	M_8265D8
	M_818513	M_30425F	M_81D6EE	M_822D5C	M_818412	M_2FA1E0	M_81C7FD	M_81D6EE	M_8280A6	M_2F15E4	M_2F15E4	M_2F9DC6	M_8175D1	M_8175D1	M_2F9435	M_2F00AF
	M_8265D8	**BW1162**	**BW1114**	M_2F1C11	M_2F9435	M_3B0B3D	M_8288B1	**BW1160**	M_81CFFC	M_2FA1E0	M_2FA1E0	M_829DF1	M_2FA1E0	M_813728	M_301505	M_818513
	BW1114	M_2F9DC6	M_2FA1E0	M_2F15E4	M_813728	M_2F20C2	M_30425F	M_2F15E4	M_2F9DC6	M_3AF886	M_823E5D	M_3BF453	M_2F9DC6	**BW1162**	M_302CA5	M_81D606
	M_812236	M_2F00AF	M_3B0B3D	M_3AF886	M_30425F	M_2F00AF	M_822D5C	M_813728	**BW1160**	**BW1160**	M_813728	M_818412	M_813728	M_2F00AF	M_3BF453	M_829DF1
	M_3BF453	M_812236	M_8288B1	M_3B0CEE	**BW1115**	M_3BF453	M_3B0B3D	M_3B0B3D	M_2F20C2	**BW1161**	M_30425F	M_8265D8	M_826B33	M_2F9DC6	M_2F20C2	M_823E5D
	M_821F00	**BW1160**	M_8280A6	M_812236	M_812236	M_826B33	M_8265D8	M_2F20C2	**BW1161**	**BW1153**	M_8280A6	M_823E5D	M_829DF1	M_818412	M_8175D1	M_822D5C
	M_823E5D	M_813728	M_822D5C	M_813728	M_81D606	M_3032C0	M_302CA5	M_812236	M_30425F	**BW1162**	**BW1161**	M_8288B1	M_818412	**BW1160**	M_81D606	M_8288B1
	M_3B0CEE	M_821F00	**BW1161**	M_818412	**BW1160**	**BW1160**	M_8175D1	M_8280A6	M_302CA5	M_81D6EE	M_818412	**BW1161**	M_3B0B3D	M_81CFFC	M_3AF886	M_3B0B3D
	M_30425F	M_2F20C2	**BW1160**	M_2FA1E0	M_81D6EE	M_822D5C	M_2F00AF	M_81D662	M_826B33	M_822D5C	M_822D5C	M_822D5C	M_8265D8	**BW1114**	M_81D662	M_2F9435
	BW1161	M_818412	M_2F00AF	M_826B33	**BW1162**	**BW1162**	M_81D606	M_8265D8	**BW1114**	**BW1114**	**BW1153**	M_2F15E4	M_2F00AF	M_826B33	**BW1162**	M_302CA5
	M_2F15E4	M_3AF886	M_813728	M_823E5D	M_2FA1E0	M_3AF886	M_2F9435	M_301505	**BW1153**	M_818513	**BW1114**	M_2F00AF	M_822D5C	M_8265D8	**BW1153**	**BW1115**
	M_826B33	M_818513	M_818412	M_3BF453	M_3AF886	M_3B0CEE	M_2FA1E0	M_822D5C	M_2F1C11	M_8265D8	M_8175D1	M_3B0CEE	**BW1153**	M_2FA1E0	**BW1161**	M_3B0CEE
	M_2F9DC6	M_826B33	M_81CFFC	M_818513	**BW1114**	M_823E5D	M_812236	M_2F00AF	M_81D6EE	M_2F9DC6	M_301505	M_3B0B3D	M_2F9435	M_822D5C	M_829DF1	**BW1161**
WORST	**BW1160**	M_3B0CEE	M_301505	**BW1162**	M_829DF1	M_818513	M_829DF1	**BW1115**	M_821F00	M_81CFFC	M_2F9DC6	M_813728	M_81C7FD	M_30425F	M_812236	**BW1162**
MATE	M_2F20C2	M_823E5D	M_2F9DC6	**BW1160**	M_2F15E4	M_2F9DC6	BW1115	M_3BF453	M_8265D8	M_8280A6	M_81CFFC	M_821F00	M_302CA5	**BW1153**	**BW1115**	M_3AF886

MATRIX CONTINUED

F E M A L E S

	F_3B027E	F_8194CD	F_81CE62	F_81D436	F_81E3DA	F_821838	F_82284C	F_825092	F_82858D	F_828D79	F_82909D	F_829864	F_82A73E	F_82ADA0	F_82AE30
BEST	M_3032C0	M_8175D1	M_81D6EE	M_81C7FD	M_3BF453	M_81D606	**BW1115**	M_302CA5	M_3BF453	M_823E5D	M_818513	M_302CA5	M_2F1C11	M_8175D1	M_81D606
MATE	M_81D6EE	M_3AF886	M_81D606	**BW1153**	M_823E5D	M_812236	M_81C7FD	M_2F9435	M_2F15E4	M_2F9DC6	M_3BF453	M_81D606	M_821F00	M_301505	M_81D6EE
	M_2F9435	**BW1162**	M_821F00	M_3AF886	M_3B0B3D	M_302CA5	M_302CA5	M_81D606	M_3032C0	M_2F9435	M_81D662	M_81D6EE	M_81D606	M_2F9DC6	M_821F00
	M_81D606	**BW1114**	M_302CA5	M_2FA1E0	M_8265D8	M_2F1C11	M_30425F	M_81D6EE	M_8265D8	M_81D606	M_818412	**BW1115**	M_8288B1	M_3AF886	M_2F9435
	M_8280A6	M_81C7FD	M_2F9435	M_302CA5	M_821F00	M_2F9435	M_818412	M_821F00	M_821F00	M_3BF453	M_3B0CEE	M_8265D8	M_81D662	**BW1114**	M_302CA5
	M_81D662	M_301505	M_829DF1	**BW1114**	M_81D6EE	M_829DF1	M_81CFFC	M_8288B1	M_2F1C11	M_3B0B3D	M_823E5D	M_8288B1	M_2F9435	M_81C7FD	M_2F1C11
	M_2F00AF	M_81D606	M_30425F	**BW1162**	M_2F9DC6	M_818513	M_2F9435	M_81D662	M_8288B1	M_81CFFC	M_2F00AF	M_2F9435	**BW1115**	M_812236	M_8288B1
	M_2F9DC6	M_81CFFC	M_2F1C11	**BW1160**	M_2F9435	M_3AF886	M_8280A6	M_3032C0	M_823E5D	M_821F00	M_2F15E4	M_8175D1	M_8175D1	M_81CFFC	M_81D662
M	M_821F00	M_812236	M_2F15E4	M_826B33	**BW1153**	M_2F15E4	**BW1153**	M_2F1C11	M_2F20C2	**BW1153**	M_3032C0	M_2FA1E0	M_302CA5	**BW1160**	M_30425F
A	M_8288B1	M_81D662	M_81D662	M_81CFFC	M_2F15E4	M_30425F	M_8265D8	**BW1162**	M_822D5C	M_8265D8	M_3AF886	M_81D662	M_81D6EE	**BW1162**	M_829DF1
L	M_3BF453	M_2F9435	M_8280A6	M_8175D1	M_81D606	M_301505	M_81D606	M_3AF886	M_8280A6	M_81D6EE	M_81D606	M_30425F	M_81CFFC	M_2FA1E0	M_3B0CEE
E	**BW1161**	**BW1160**	**BW1115**	M_81D6EE	**BW1161**	**BW1162**	M_829DF1	M_3B0B3D	M_8175D1	**BW1161**	M_81D6EE	M_822D5C	M_2F15E4	M_81D606	M_2F15E4
S	M_3B0B3D	M_2F9DC6	M_3B0B3D	M_81D662	M_2F1C11	M_81C7FD	M_301505	M_2F20C2	M_3B0B3D	M_8280A6	M_2F9DC6	**BW1153**	**BW1114**	M_2F20C2	M_301505
	M_823E5D	M_2FA1E0	M_3B0CEE	M_30425F	M_826B33	**BW1115**	**BW1161**	M_829DF1	**BW1115**	M_81D662	M_2F1C11	M_301505	M_829DF1	M_826B33	M_3032C0
	BW1114	M_822D5C	M_8288B1	M_301505	M_81C7FD	M_826B33	M_81D6EE	**BW1153**	M_81D6EE	M_3032C0	M_2F9435	M_81CFFC	M_818412	M_2F9435	M_2F00AF
	M_2F20C2	**BW1153**	M_818513	M_3032C0	M_3B0CEE	**BW1114**	**BW1160**	M_3B0CEE	M_81CFFC	M_2F15E4	M_8280A6	M_2F00AF	M_3B0B3D	M_8280A6	M_3B0B3D
	M_301505	M_2F00AF	M_3032C0	M_818513	M_8288B1	M_8280A6	M_826B33	M_823E5D	M_2F9DC6	M_2F20C2	M_302CA5	M_829DF1	M_2FA1E0	M_302CA5	**BW1115**
	M_3AF886	M_3032C0	M_818412	M_8280A6	M_81CFFC	**BW1160**	M_81D662	**BW1161**	**BW1161**	M_3B0CEE	M_813728	**BW1162**	M_3BF453	M_2F00AF	M_8175D1
	M_818513	M_2F20C2	M_301505	M_822D5C	M_8280A6	M_8175D1	M_8175D1	M_2F00AF	M_818513	M_8288B1	M_826B33	M_3B0B3D	M_81C7FD	M_30425F	M_812236
	M_302CA5	M_302CA5	M_8265D8	M_2F1C11	M_81D662	M_2F20C2	M_2FA1E0	**BW1115**	M_812236	M_302CA5	**BW1160**	M_81C7FD	M_2F00AF	M_829DF1	M_8265D8
	BW1153	M_818412	M_2F00AF	M_81D606	M_3032C0	M_81D662	M_2F00AF	**BW1114**	**BW1114**	M_822D5C	**BW1161**	M_3B0CEE	M_8280A6	**BW1153**	M_8280A6
	M_81CFFC	M_826B33	M_813728	M_2F9DC6	M_822D5C	M_813728	M_2F20C2	M_2FA1E0	M_826B33	M_818412	M_829DF1	**BW1161**	M_823E5D	M_81D6EE	**BW1153**
	M_2F1C11	M_3BF453	M_3BF453	M_812236	M_2F20C2	M_3BF453	M_822D5C	M_81C7FD	M_813728	M_829DF1	M_2F20C2	**BW1114**	M_3032C0	**BW1115**	M_823E5D
	M_81C7FD	M_823E5D	**BW1114**	M_829DF1	**BW1160**	M_81CFFC	M_813728	M_818513	M_30425F	M_818513	**BW1114**	M_2F15E4	M_2F20C2	M_3032C0	**BW1114**
	M_3B0CEE	M_2F1C11	M_3AF886	M_2F9435	M_302CA5	**BW1161**	M_812236	M_81CFFC	**BW1162**	M_3AF886	**BW1162**	M_818412	M_8265D8	M_822D5C	M_2F20C2
	M_813728	M_829DF1	M_812236	M_8288B1	M_818412	M_818412	M_3B0B3D	M_822D5C	**BW1160**	M_2F1C11	M_301505	M_821F00	**BW1162**	M_818412	M_3BF453
	M_818412	M_813728	**BW1153**	M_8265D8	M_829DF1	M_2FA1E0	M_3B0CEE	M_2F9DC6	**BW1153**	M_812236	M_81CFFC	M_823E5D	M_30425F	M_813728	M_818513
	BW1160	M_8280A6	**BW1161**	M_2F20C2	**BW1115**	M_81D6EE	**BW1114**	M_818412	M_3B0CEE	**BW1114**	M_3B0B3D	M_3032C0	M_301505	M_8265D8	M_813728
	M_8265D8	M_818513	M_81C7FD	M_818412	M_813728	M_821F00	M_821F00	M_813728	M_818412	M_81C7FD	M_821F00	M_2F1C11	**BW1161**	M_823E5D	M_826B33
	M_829DF1	M_30425F	M_823E5D	**BW1115**	M_812236	M_2F9DC6	M_2F9DC6	M_8265D8	M_301505	M_2F00AF	M_30425F	M_3AF886	M_3B0CEE	**BW1161**	**BW1162**
	M_822D5C	M_2F15E4	M_8175D1	M_813728	M_30425F	M_8265D8	M_3BF453	M_8175D1	M_2FA1E0	M_813728	M_822D5C	M_8280A6	M_822D5C	M_81D662	M_3AF886
	M_2F15E4	**BW1115**	M_81CFFC	M_2F00AF	M_3AF886	M_2F00AF	M_2F1C11	M_8280A6	M_3AF886	M_826B33	**BW1153**	M_3BF453	M_812236	M_818513	M_81CFFC
	M_8175D1	M_8265D8	M_2F20C2	M_823E5D	**BW1162**	M_3B0CEE	M_3AF886	M_2F15E4	M_81D662	M_8175D1	M_8265D8	M_818513	M_3AF886	M_8288B1	M_822D5C
	M_826B33	M_8288B1	M_2FA1E0	M_3B0B3D	M_818513	M_823E5D	M_3032C0	M_301505	M_81C7FD	**BW1162**	M_81C7FD	M_2F9DC6	M_818513	M_2F1C11	M_81C7FD
	BW1162	M_81D6EE	M_826B33	M_3BF453	M_2F00AF	**BW1153**	M_818513	M_3BF453	M_2F00AF	M_30425F	M_812236	M_2F20C2	M_813728	M_3B0CEE	M_2FA1E0
	BW1115	**BW1161**	M_2F9DC6	M_2F15E4	M_8175D1	M_3032C0	M_8288B1	**BW1160**	M_829DF1	**BW1160**	M_8288B1	M_812236	**BW1153**	M_2F15E4	M_818412
	M_30425F	M_3B0CEE	**BW1160**	**BW1161**	**BW1114**	M_822D5C	M_2F15E4	M_826B33	M_302CA5	M_2FA1E0	M_2FA1E0	M_813728	M_2F9DC6	M_3B0B3D	**BW1161**
WORST	M_812236	M_3B0B3D	M_822D5C	M_3B0CEE	M_301505	M_3B0B3D	**BW1162**	M_812236	M_81D606	M_301505	M_8175D1	**BW1160**	M_826B33	M_821F00	**BW1160**
MATE	M_2FA1E0	M_821F00	**BW1162**	M_821F00	M_2FA1E0	M_8288B1	M_823E5D	M_30425F	M_2F9435	**BW1115**	**BW1115**	M_826B33	**BW1160**	M_3BF453	M_2F9DC6

SCOTT CREEK COHO BREEDING MATRIX, WEEK 2 **DATE: 13 JAN 2005**

SAMPLES COLLECTED BY 10 JAN 2005
FEMALES LISTED ALONG TOP, MALES RANKED FROM BEST TO WORST MATE FOR EACH FEMALE
FIRST 3 FEMALES ARE WILD CAUGHT (FLOY TAG), REST ARE BROODSTOCK
SHADED: AVOID THESE MATINGS IF POSSIBLE, USE ONLY AS LAST RESORT (RXY>0.25)
UNDERLINED/ITAL.: DO NOT MATE, RELATED AT RXY>0.50 (FULL SIBLING)
BOLD: WILD FISH, STREAM CAPTURED SPAWNING RETURN ALL OTHERS:CAPTIVE BROODSTOCK

F E M A L E S

	PW1055	**PW1028**	**Pink390**	PR0925	PR0924	PR0923	PR0922	PR0921	PR0920	PR0919	PR0918	PR0916	PR0914	PR0913
BEST	M_2FA1E0	**BW1115**	BR1019	**BW1114**	BR1019	BR0977	M_302CA5	BR0990	BR0992	BR1019	BR0992	BR1017	M_3032C0	**BW1114**
MATE	BR0991	**BW1161**	**BW2001**	BR0975	BR0980	BR0992	BR1019	BR1021	BR1020	BR0978	BR0984	BR1019	BR0995	M_3032C0
	BR0990	BR0978	BR0989	BR0999	BR1017	BR0983	BR0995	BR1019	BR0998	**BW2002**	M_3032C0	M_302CA5	BR1017	BR0984
	BW1114	M_302CA5	**BW1115**	BR0995	BR0990	BR0994	**BW1115**	BR0989	BR0982	M_302CA5	BR0982	BR0983	BR1019	BR0996
	BR0993	M_829DF1	BR0995	**BW2002**	M_302CA5	**BW2002**	BR0982	BR0983	BR1021	BR0990	BR1021	BR1021	BR1000	BR0981
	BR1021	BR0998	M_302CA5	BR1000	BR0978	BR0980	BR0989	BR1017	BR0995	BR1017	BR0990	BR0995	BR0983	BR0994
	BW1115	BR1019	BR0983	BR0991	M_829DF1	BR1020	BR1017	**BW1115**	BR0996	M_829DF1	BR0989	BR1000	BR0981	BR0990
M	BR0988	BR0984	BR0987	BR0994	BR0992	BR0981	BR0991	BR0991	BR1017	BR0977	BR1020	**BW1115**	BR0996	BR1020
A	BR0989	BR0997	BR0999	BR0990	BR0988	BR0984	**BW2002**	M_302CA5	BR0984	BR1018	BR0997	BR0990	BR1021	**BW2002**
L	BR0978	M_2FA1E0	BR1017	BR0985	BR1021	M_3032C0	M_2FA1E0	BR0995	BR1019	BR0984	BR0919	BR0992	BR0989	BR0993
E	M_829DF1	BR0989	BR0990	BR0983	BR0981	BR1018	BR0983	BR0975	**BW1161**	BR0988	BR1000	BR1018	BR0992	BR0982
S	BR0981	BR0975	BR0991	BR0996	BR0997	BR1019	BR0988	BR0984	BR0990	BR0999	BR0991	BR0989	**BW1161**	BR0980
	BR1018	BR1000	M_3032C0	BR0992	**BW1115**	BR0995	BR0919	**BW1114**	BR0993	BR0987	BR0998	BR0997	BR0998	BR0975
	BW1161	BR1017	BR0998	BR0978	BR0983	BR0996	BR0999	M_829DF1	BR0987	**BW1115**	**BW1115**	M_829DF1	BR1020	BR1000
	BR0999	BR0991	**BW2002**	BR0997	BR0991	BR0990	BR0975	BR0994	BR0980	BR0993	BR0995	BR0978	**BW1114**	BR0977
	M_302CA5	BR0919	BR0975	M_3032C0	BR0998	BR1017	BR0981	BR0998	BR0989	**BW1114**	BR0975	BR1020	BR0997	BR0988
	BR0997	BR0992	BR0981	BR0988	**BW2001**	BR1000	M_829DF1	M_2FA1E0	BR0975	BR1000	BR0996	M_3032C0	BR0999	M_2FA1E0
	BW2001	BR0996	BR0919	BR0993	BR0989	M_302CA5	BR0998	BR0992	BR1000	BR0991	**BW1161**	BR0998	BR1018	BR0998
	BR0987	BR0985	BR0994	BR0987	BR0999	BR0985	BR0987	BR0987	BR0983	BR0997	BR0977	BR0984	BR0977	BR0995
	BR1020	BR0980	M_829DF1	M_2FA1E0	BR1020	BR0993	BR0980	BR0981	M_3032C0	BR0983	BR0978	**BW1161**	M_302CA5	BR0985
	BR0980	BR0987	BR1018	BR0984	M_3032C0	**BW1161**	**BW2001**	BR1000	BR0919	BR0985	**BW1114**	BR0980	BR0975	BR0919
	M_3032C0	BR1020	BR1000	BR1021	BR0985	M_829DF1	**BW1161**	BR1020	BR0997	BR0992	BR0993	BR0999	BR0990	BR0987
	BR1019	BR0994	M_2FA1E0	BR0982	BR0994	BR0997	**BW1114**	M_3032C0	M_302CA5	BR0975	BR0985	BR0977	BR0987	BR1021
	BR0982	M_3032C0	BR0985	BR0981	BR0987	**BW1114**	BR0984	BR0997	**BW2002**	**BW1161**	BR0988	BR0987	BR0980	BR0989
	BR0994	BR1018	BR0977	**BW2001**	BR0993	BR0999	BR0994	BR0982	BR0994	BR0994	BR0980	BR0991	BR0985	BR1017
	BR0977	BR0990	BR0982	BR0977	BR0984	BR0975	BR1021	BR0988	M_829DF1	M_2FA1E0	**BW2002**	BR0985	**BW2001**	BR0999
	BR0984	BR0999	**BW1114**	BR1019	M_2FA1E0	BR0998	BR1020	BR0999	**BW1115**	BR0995	BR0994	BR0981	BR0994	M_302CA5
	BR0975	**BW2001**	BR0978	M_829DF1	BR1018	BR1021	M_3032C0	**BW1161**	BR0985	BR1021	BR0999	BR0996	BR0982	BR0992
	BR1017	BR0988	BR0992	BR1020	**BW1161**	BR0988	BR0990	BR0980	BR0978	**BW2001**	M_2FA1E0	BR0994	M_829DF1	BR0997
	BR0998	BR0977	BR1021	BR0919	BR0995	BR0919	BR1018	BR0919	BR0988	BR0996	BR1018	BR0975	**BW2002**	BR0991
	BR0985	BR0981	BR1020	BR0989	BR0919	BR0982	BR1000	BR0978	BR1018	BR0982	BR0983	**BW1114**	BR0919	BR1019
	BR0996	BR1021	BR0980	BR0998	**BW1114**	BR0987	BR0992	**BW2002**	BR0977	BR0981	BR0987	BR0993	BR0984	BR1018
	BR0995	**BW1114**	BR0988	BR1017	**BW2002**	BR0978	BR0977	BR1018	**BW2001**	BR0980	**BW2001**	BR0982	BR0991	BR0983
	BR1000	**BW2002**	**BW1161**	M_302CA5	BR0977	BR0989	BR0996	BR0977	BR0981	BR1020	BR0981	**BW2002**	BR0993	**BW1161**
	BR0919	BR0982	BR0984	**BW1115**	BR0982	M_2FA1E0	BR0997	BR0985	BR0991	M_3032C0	M_829DF1	M_2FA1E0	**BW1115**	**BW2001**
	BW2002	BR0993	BR0993	BR0980	BR0996	**BW2001**	BR0978	**BW2001**	**BW1114**	BR0919	M_302CA5	**BW2001**	BR0988	M_829DF1
WORST	BR0983	BR0995	BR0996	**BW1161**	BR0975	BR0991	BR0985	BR0996	BR0999	*BR0998*	BR1019	BR0919	BR0978	BR0978
MATE	BR0992	BR0983	BR0997	BR1018	BR1000	**BW1115**	*BR0993*	BR0993	M_2FA1E0	*BR0989*	BR1017	BR0988	M_2FA1E0	**BW1115**

MATRIX CONTINUED

F E M A L E S

	PR0912	PR0911	PR0910	PR0909	PR0908	PR0907	PR0906	PR0905	PR0904	PR0902	PR0901	PR0900	PB 0915	F_82ADA0
BEST	BR0992	**BW1115**	BR0987	**BW1114**	BR0991	BR1019	BR0995	**BW1115**	M_302CA5	BR0992	BR0977	BR0991	BR1020	BR0991
MATE	BR0981	BR0987	BR1018	M_2FA1E0	BR0990	BR0995	BR1019	BR1017	BR1017	**BW2002**	BR0996	BR1018	BR0996	BR0999
	BR1020	M_302CA5	M_2FA1E0	BR0996	M_2FA1E0	BR1021	BR1021	M_829DF1	BR1019	BR0984	BR0983	**BW1114**	BR1017	BR0996
	M_3032C0	BR0988	M_302CA5	BR1018	**BW1114**	BR1017	M_302CA5	M_302CA5	BR0995	BR1021	BR0984	BR0987	BR1019	BR1018
	BR0999	BR0994	**BW1114**	BR0993	M_302CA5	M_302CA5	BR1017	BR0980	BR1021	BR0990	**BW1114**	BR0999	BR0992	**BW1114**
	BR0998	**BW2001**	BR0993	BR0975	BR0987	BR0990	M_829DF1	BR0977	BR0989	M_3032C0	M_3032C0	BR1019	BR0998	BR0987
	BR0980	BR0975	BR0975	M_3032C0	BR0983	BR0989	BR0988	BR1019	BR0983	BR0995	BR0992	BR0975	BR0975	BR0978
M	BR0977	BR1017	**BW2001**	BR0977	BR0993	BR0983	**BW2002**	BR0978	M_3032C0	BR0980	BR0995	BR0978	**BW2002**	BR0975
A	BR0991	BR1000	BR0991	BR0991	BR0978	BR0988	BR0990	BR1018	BR0990	BR0983	**BW2002**	BR0983	BR1021	M_2FA1E0
L	**BW2002**	BR0982	BR0995	BR1019	BR1018	M_829DF1	BR0984	BR0989	BR1018	BR0989	BR1000	BR1017	BR0982	BR1019
E	BR0994	BR1019	BR0983	BR0980	BR0975	BR0980	BR0983	BR1021	**BW2001**	BR1020	BR0994	BR0996	BR0995	BR0997
S	BR0985	M_829DF1	BR0988	BR0988	BR1019	BR0984	BR1000	BR0998	BR0998	BR0977	BR0975	M_2FA1E0	**BW1161**	BR0993
	M_2FA1E0	BR0999	BR0999	BR0989	BR0997	BR0999	**BW1115**	BR0995	BR0997	**BW1161**	BR1020	BR0919	BR1000	BR1017
	BR0919	**BW1161**	M_3032C0	BR1020	BR1000	**BW2001**	BR0998	**BW2002**	M_829DF1	BR0988	BR1018	BR0981	BR0983	BR1000
	BW1115	BR0995	**BW2002**	M_302CA5	**BW2002**	M_3032C0	BR0980	BR0992	BR0980	BR0978	BR0985	M_3032C0	M_3032C0	M_302CA5
	BR1019	BR0993	BR0977	M_829DF1	BR0999	BR0981	BR0989	**BW2001**	BR1020	**BW1114**	BR0980	BR0997	BR0984	BR0981
	BR0983	BR0983	BR1000	**BW1161**	BR0995	BR0998	**BW2001**	BR0981	**BW1161**	BR0999	BR0990	M_302CA5	BR0997	BR0988
	BR1017	BR0991	BR0919	BR0990	**BW1115**	**BW2002**	BR0977	BR0997	BR0981	BR1018	**BW1161**	BR0994	BR0980	M_829DF1
	BR0989	M_2FA1E0	BR0990	BR1021	BR0988	**BW1115**	M_3032C0	BR0987	**BW1115**	BR1019	BR0993	BR0993	BR0989	BR0995
	M_829DF1	BR0981	BR1019	BR1017	BR1017	BR0991	BR0994	BR0983	**BW1114**	BR0997	BR0997	BR0992	M_302CA5	**BW1115**
	BR1018	BR0997	BR0996	**BW2002**	M_3032C0	BR0978	BR0999	BR0982	M_2FA1E0	**BW1115**	BR0999	BR1020	BR0919	M_3032C0
	BR0978	BR0919	BR0978	BR0987	BR0977	BR0982	BR0982	M_3032C0	BR0987	BR0975	BR1021	BR0990	BR0994	BR0919
	BR0984	BR0985	M_829DF1	BR0994	BR0996	BR1000	BR0981	BR0990	BR0977	BR1000	BR0987	M_829DF1	M_829DF1	**BW2001**
	BR0987	BR0978	BR1017	BR0995	**BW2001**	BR1020	BR0985	BR0993	BR0975	BR0991	BR0989	BR0985	BR0977	BR0994
	BR1000	BR0998	BR0989	BR0984	M_829DF1	**BW1114**	BR0992	BR0984	BR0919	M_2FA1E0	BR0988	BR1000	BR1018	BR0985
	BW2001	BR0980	BR0982	BR0985	BR0992	BR0997	**BW1114**	M_2FA1E0	BR0996	BR0996	BR0919	**BW2002**	BR0990	BR0982
	BR0975	**BW1114**	BR0997	**BW2001**	BR0994	BR0992	BR1018	BR1020	BR0994	BR0985	BR0998	**BW2001**	BR0978	BR1020
	BR0996	BR1021	BR0994	BR0998	BR0982	BR0977	BR0978	BR0985	BR0985	BR0993	BR0982	BR0977	**BW1114**	**BW1161**
	BR0997	BR0996	**BW1115**	BR0997	BR1020	BR0985	**BW1161**	BR0988	BR0982	M_829DF1	M_302CA5	BR0988	BR0987	BR0983
	BW1161	**BW2002**	BR0985	BR0978	BR0989	BR0993	BR0987	BR1000	BR0991	BR0994	BR0991	BR0984	BR0981	BR0977
	BR0988	BR0992	BR0981	BR1000	**BW1161**	BR1018	BR1020	**BW1161**	BR1000	BR0998	BR0981	**BW1115**	**BW2001**	BR0989
	M_302CA5	BR0990	BR1020	BR0983	BR0919	BR0975	BR0991	BR0994	**BW2002**	BR0982	BR1019	BR0982	BR0985	BR0990
	BR0993	BR1018	BR0998	BR0982	BR0984	BR0919	BR0975	BR0919	BR0984	**BW2001**	BR1017	BR0989	BR0993	**BW2002**
	BW1114	M_3032C0	BR0992	BR0999	BR0981	BR0987	BR0997	**BW1114**	BR0999	BR0981	M_2FA1E0	BR0995	BR0991	BR0980
	BR0990	BR0977	BR0984	BR0919	BR0980	M_2FA1E0	M_2FA1E0	BR0991	BR0992	BR0919	**BW2001**	**BW1161**	BR0988	BR0984
	BR0995	BR0989	**BW1161**	BR0981	*BR0998*	BR0994	BR0993	BR0999	BR0993	BR1017	BR0978	BR0980	M_2FA1E0	BR0998
WORST	BR1021	BR0984	BR0980	**BW1115**	*BR0985*	**BW1161**	BR0996	BR0996	BR0978	BR0987	M_829DF1	BR0998	BR0999	BR1021
MATE	BR0982	BR1020	*BR1021*	BR0992	*BR1021*	BR0996	BR0919	*BR0975*	BR0988	M_302CA5	**BW1115**	*BR1021*	**BW1115**	BR0992

SCOTT CREEK COHO BREEDING MATRIX, WEEK 3 **DATE: 23 JAN 2005**

SAMPLES COLLECTED BY 18 JAN 2005
FEMALES LISTED ALONG TOP, MALES RANKED FROM BEST TO WORST MATE FOR EACH FEMALE
FIRST 4 FEMALES ARE WILD CAUGHT (FLOY TAG), REST ARE BROODSTOCK; **BOLD** INDICATES CAPTIVE BROOD IN SPAWN TANK
SHADED AVOID THESE MATINGS IF POSSIBLE, USE ONLY AS LAST RESORT (RXY>0.25)
UNDERLINED/ITAL. DO NOT MATE, RELATED AT RXY>0.50 (FULL SIBLING)
BOLD: WILD FISH, STREAM CAPTURED SPAWNING RETURN ALL OTHERS:CAPTIVE BROODSTOCK

F E M A L E S

	PW2378	**PW2377**	**PW2376**	**PW1055**	PR0917	PR0916	PR0912	PR0908	PR0905	PR0904	PR0901	PR0899	PR0898	PB 0915	PR0900	PR0902
BEST	BR0990	BR1017	BR0975	M_2FA1E0	BR1000	BR1017	**BW1159**	BR0991	**BW2132**	M_302CA5	BR0977	BR0999	**BW2024**	BR1020	BR0991	BR0992
MATE	**BW2128**	M_302CA5	BR0989	BR0991	BR0983	BR1019	BR0992	BR0990	BR1017	BR1017	BR0996	**BW2002**	BR0990	BR0996	BR1018	**BW2002**
	BR1021	BR1020	BR0995	BR0990	**BW2130**	M_302CA5	BR0981	M_2FA1E0	**BW2130**	BR1019	BR0983	BR0977	BR1021	BR1017	**BW2003**	BR0984
	BR1000	**BW2129**	BR0996	**BW2003**	BR0992	BR0983	BR1020	**BW2003**	M_829DF1	BR0995	BR0984	BR1019	M_3032C0	**BW2129**	BR0987	**BW2024**
	BW2024	BR1018	**BW2127**	**BW2128**	BR0990	**BW2130**	M_3032C0	M_302CA5	M_302CA5	BR1021	**BW2130**	BR0988	**BW2128**	**BW2127**	BR0999	**BW2128**
	BR0993	**BW2131**	BR0982	BR0993	**BW2128**	BR1021	BR0999	**BW2126**	**BW1159**	**BW2129**	**BW2003**	**BW1159**	BR0978	BR1019	BR1019	BR1021
	BR1018	BR0995	BR0919	BR1021	BR0995	BR0995	BR0998	BR0987	**BW2024**	BR0989	M_3032C0	M_2FA1E0	**BW1155**	BR0992	BR0975	**BW1155**
	BW2126	BR0994	**BW2131**	**BW2131**	M_3032C0	BR1000	BR0980	BR0983	BR0980	**BW1159**	BR0992	BR0991	**BW2132**	BR0998	BR0978	BR0990
M	**BW2130**	BR0987	M_3032C0	**BW2132**	**BW2024**	**BW2129**	BR0977	**BW2131**	**BW1155**	BR0983	BR0995	**BW2001**	BR0975	**BW2128**	BR0983	M_3032C0
A	**BW2131**	**BW2127**	BR0991	BR0988	M_302CA5	BR0990	**BW2131**	**BW2024**	BR0977	M_3032C0	**BW2002**	**BW2131**	BR1000	BR0975	**BW2131**	**BW1159**
L	BR1017	BR0982	BR0994	**BW1159**	BR1019	**BW1155**	BR0991	BR0993	BR1019	**BW2130**	BR1000	BR0983	BR0984	**BW2002**	BR1017	**BW2131**
E	BR0977	BR1019	M_2FA1E0	BR0989	**BW1155**	BR0992	**BW2002**	BR0978	BR0978	BR0990	**BW2128**	BR0980	BR0995	BR1021	**BW2127**	BR0995
S	BR1019	**BW2002**	BR1017	BR0978	BR1021	**BW2126**	BR0994	BR1018	BR1018	BR1018	BR0994	BR0975	**BW1159**	**BW2126**	BR0996	BR0980
	M_302CA5	BR0992	**BW2128**	M_829DF1	BR0984	**BW2024**	BR0985	BR0975	BR0989	**BW2001**	BR0975	BR0984	BR0989	BR0982	M_2FA1E0	BR0983
	BR0991	BR0998	**BW2126**	BR0981	BR0980	BR1018	M_2FA1E0	**BW2132**	BR1021	BR0998	BR1020	BR0987	**BW1161**	BR0995	**BW1159**	BR0989
	BR0995	BR0990	**BW1159**	BR1018	**BW2003**	BR0989	**BW2024**	BR1019	**BW2126**	**BW1155**	BR1018	BR1018	M_302CA5	**BW1161**	BR0919	BR1020
	BR0980	BR0996	BR0999	**BW1161**	**BW2131**	**BW2132**	BR0919	BR0997	BR0998	BR0997	**BW1159**	BR1017	BR0998	**BW1155**	BR0981	BR0977
	BW1155	BR0993	BR1018	BR0999	BR0997	BR0997	BR1019	**BW2130**	BR0995	**BW2127**	BR0985	BR1000	BR0992	BR1000	M_3032C0	**BW1161**
	BR0987	BR0975	BR0998	M_302CA5	BR1017	M_829DF1	BR0983	**BW2127**	**BW2002**	M_829DF1	**BW2129**	**BW2003**	M_829DF1	BR0983	BR0997	**BW2132**
	BW2132	BR1021	**BW2003**	**BW2126**	**BW2132**	BR0978	BR1017	BR1000	**BW2129**	BR0980	BR0980	M_3032C0	BR0991	M_3032C0	M_302CA5	BR0988
	BR1020	BR1000	**BW2001**	BR0997	BR1020	BR1020	BR0989	**BW2002**	**BW2128**	BR1020	BR0990	BR0978	BR0977	BR0984	**BW2126**	BR0978
	BR0997	BR0980	BR0980	**BW2024**	BR0988	M_3032C0	M_829DF1	**BW2128**	BR0992	**BW1161**	**BW1161**	BR0994	**BW2130**	BR0997	BR0994	**BW2003**
	BR0983	BR0977	**BW2129**	**BW2001**	**BW2127**	BR0998	BR1018	BR0999	**BW2001**	BR0981	**BW2127**	**BW2130**	BR0985	**BW2131**	BR0993	BR0999
	BR0988	BR0981	BR0988	BR0987	BR0977	BR0984	BR0978	BR0995	BR0981	**BW2131**	BR0993	BR0985	BR0997	**BW1159**	BR0992	BR1018
	BR0978	M_829DF1	BR0981	BR1020	BR0981	**BW2131**	BR0984	BR0988	BR0997	**BW2003**	BR0997	BR0996	BR1019	BR0980	BR1020	BR1019
	BW2129	**BW2126**	**BW2002**	BR0980	BR0989	**BW1161**	BR0987	BR1017	BR0987	**BW2126**	**BW2024**	**BW2024**	BR0988	BR0989	BR0990	BR0997
	M_3032C0	BR0991	BR1021	M_3032C0	BR0978	BR0980	BR1000	M_3032C0	BR0983	M_2FA1E0	BR0999	M_302CA5	**BW2003**	M_302CA5	M_829DF1	BR0975
	M_829DF1	**BW2128**	M_302CA5	BR1019	BR0996	**BW2127**	**BW2001**	BR0977	BR0982	BR0987	**BW2131**	**BW2129**	BR0994	BR0919	**BW2132**	BR1000
	BR0992	**BW2132**	BR0987	BR0982	BR0993	**BW1159**	BR0975	BR0996	M_3032C0	BR0977	BR1021	BR0990	BR0999	BR0994	BR0985	**BW2129**
	BW2003	BR0919	BR1020	**BW2129**	M_829DF1	BR0999	BR0996	**BW2001**	BR0990	BR0975	BR0987	M_829DF1	BR1017	M_829DF1	**BW2024**	BR0991
	BW1159	BR0999	**BW1161**	BR0994	**BW2126**	BR0977	BR0997	M_829DF1	**BW2131**	BR0919	BR0989	BR0981	**BW2129**	BR0977	BR1000	M_2FA1E0
	BR0989	**BW1161**	BR0990	BR0977	BR1018	BR0987	**BW2129**	BR0992	BR0993	**BW2128**	**BW1155**	BR1020	**BW2002**	BR1018	**BW2002**	BR0996
	BR0996	BR0997	**BW2132**	BR0984	BR0998	BR0991	**BW1161**	BR0994	BR0984	BR0996	BR0988	BR0997	**BW2126**	BR0990	**BW2001**	**BW2130**
	BR0999	BR0983	BR0985	**BW1155**	BR0975	BR0985	BR0988	**BW1155**	M_2FA1E0	BR0994	BR0919	**BW2126**	**BW2001**	BR0978	BR0977	BR0985
	BR0975	BR0984	BR0977	BR0975	BR0999	BR0981	**BW1155**	BR0982	BR1020	BR0985	BR0998	BR0993	BR0919	**BW2003**	**BW2130**	BR0993
	BW2127	BR0989	BR1019	BR1017	**BW2129**	BR0996	M_302CA5	**BW1159**	BR0985	BR0982	BR0982	BR0995	BR0980	**BW2130**	BR0988	M_829DF1
	BR0984	**BW2003**	**BW2130**	BR0998	BR0991	**BW2128**	**BW2132**	BR1020	BR0988	BR0991	M_302CA5	BR0998	**BW2127**	BR0987	BR0984	BR0994
	BR0985	M_3032C0	BR0993	BR0985	BR0982	BR0994	BR0993	**BW2129**	BR1000	**BW2132**	BR0991	**BW1161**	BR0981	BR0981	BR0982	BR0998
	BW1161	BR0985	**BW1155**	BR0996	BR0994	BR0975	**BW2003**	BR0989	**BW1161**	BR1000	BR0981	BR0989	BR0996	**BW2001**	BR0989	BR0982
	BR0981	M_2FA1E0	BR0997	BR0995	**BW1159**	**BW2003**	**BW2128**	**BW1161**	BR0994	**BW2002**	BR1019	BR0992	BR0983	BR0985	BR0995	**BW2001**
	M_2FA1E0	**BW2130**	BR1000	BR1000	**BW2002**	BR0993	BR0990	BR0919	BR0919	BR0984	**BW2132**	BR0919	BR0993	**BW2132**	**BW1161**	BR0981
	BR0998	**BW1159**	BR0984	**BW2127**	BR0985	BR0982	BR0995	BR0984	**BW2003**	BR0999	BR1017	**BW1155**	BR0982	BR0993	**BW1155**	BR0919
	BR0982	**BW1155**	BR0992	BR0919	BR0987	**BW2002**	BR1021	BR0981	**BW2127**	BR0992	M_2FA1E0	**BW2127**	BR0987	BR0991	BR0980	BR1017
	BR0994	BR0978	**BW2024**	**BW2002**	M_2FA1E0	M_2FA1E0	**BW2127**	*BR0980*	BR0991	BR0993	**BW2001**	BR0982	**BW2131**	BR0988	**BW2129**	BR0987
	BW2002	**BW2024**	BR0983	**BW2130**	BR0919	**BW2001**	BR0982	*BR0998*	BR0999	BR0978	BR0978	**BW2128**	BR1020	**BW2024**	BR0998	M_302CA5
WORST	**BW2001**	**BW2001**	BR0978	BR0983	**BW2001**	BR0919	**BW2130**	*BR0985*	BR0996	**BW2024**	**BW2126**	BR1021	BR1018	M_2FA1E0	***BW2128***	**BW2126**
MATE	BR0919	BR0988	M_829DF1	BR0992	**BW1161**	BR0988	**BW2126**	*BR1021*	*BR0975*	BR0988	M_829DF1	**BW2132**	M_2FA1E0	BR0999	*BR1021*	**BW2127**

MATRIX CONTINUED **F E M A L E S**

	PR0906	PR0907	PR0909	PR0910	PR0911	PR0913	PR0914	PR0918	PR0919	PR0920	PR0921	PR0922	PR0923	PR0924	PR0925	PR0948
BEST	BR0995	**BW2130**	**BW2003**	BR0987	BR0987	**BW2003**	M_3032C0	BR0992	BR1019	BR0992	BR0990	M_302CA5	BR0977	BR1019	**BW2003**	BR0991
MATE	BR1019	BR1019	M_2FA1E0	**BW2126**	M_302CA5	**BW2128**	**BW2130**	BR0984	BR0978	BR1020	BR1021	BR1019	BR0992	**BW2024**	BR0975	BR0999
	BR1021	BR0995	BR0996	BR1018	BR0988	M_3032C0	BR0995	**BW2128**	**BW2002**	**BW2128**	BR1019	BR0995	BR0983	BR0980	BR0999	BR0996
	BW2130	BR1021	BR1018	M_2FA1E0	BR0994	**BW2127**	BR1017	M_3032C0	**BW2131**	BR0998	**BW2024**	BR0982	BR0994	BR1017	BR0995	BR1018
	M_302CA5	BR1017	BR0993	M_302CA5	**BW2001**	BR0984	BR1019	**BW2024**	M_302CA5	BR0982	**BW2128**	**BW2127**	**BW2002**	BR0990	**BW2024**	**BW2003**
	BR1017	M_302CA5	BR0975	**BW2003**	**BW2126**	BR0996	**BW1159**	BR0982	**BW2130**	BR1021	BR0989	BR0989	BR0980	M_302CA5	**BW2002**	BR0987
	M_829DF1	BR0990	**BW2127**	BR0993	BR0975	BR0981	**BW2131**	BR1021	**BW2024**	BR0995	BR0983	BR1017	BR1020	BR0978	BR1000	BR0978
	BW1159	**BW2126**	M_3032C0	**BW2127**	BR1017	BR0994	**BW1155**	BR0990	BR0990	BR0996	BR1017	BR0991	**BW2130**	**BW2132**	BR0991	**BW2131**
M	BR0988	BR0989	BR0977	BR0975	BR1000	**BW2131**	BR1000	BR0989	BR1017	BR1017	BR0991	**BW2129**	BR0981	M_829DF1	BR0994	BR0975
A	**BW2128**	BR0983	BR0991	**BW2001**	BR0982	BR0990	BR0983	BR1020	M_829DF1	**BW2129**	M_302CA5	**BW2002**	BR0984	BR0992	BR0990	M_2FA1E0
L	**BW2126**	BR0988	BR1019	BR0991	**BW2024**	BR1020	BR0981	BR0997	BR0977	BR0984	**BW2132**	M_2FA1E0	M_3032C0	**BW1155**	BR0985	BR1019
E	**BW2002**	M_829DF1	**BW2131**	**BW2130**	**BW2128**	**BW2002**	BR0996	BR0919	BR1018	**BW2127**	BR0995	BR0983	BR1018	BR0988	BR0983	**BW2127**
S	BR0990	**BW2024**	**BW2129**	BR0995	**BW2130**	BR0993	BR1021	**BW1155**	BR0984	BR1019	**BW2129**	BR0988	BR1019	BR1021	BR0996	BR0997
	BR0984	**BW2129**	**BW2128**	BR0983	BR1019	BR0982	BR0989	BR1000	BR0988	**BW2126**	BR0975	BR0919	BR0995	BR0981	BR0992	**BW2126**
	BW1155	BR0980	BR0980	BR0988	M_829DF1	BR0980	BR0992	BR0991	BR0999	**BW1161**	**BW1155**	BR0999	**BW2129**	BR0997	BR0978	BR0993
	BR0983	BR0984	BR0988	BR0999	BR0999	BR0975	**BW2129**	BR0998	BR0987	BR0990	BR0984	BR0975	BR0996	BR0983	**BW2130**	BR1017
	BR1000	**BW1155**	BR0989	M_3032C0	**BW2127**	BR1000	**BW2127**	**BW2132**	BR0993	BR0993	**BW2003**	**BW2130**	BR0990	BR0991	BR0997	BR1000
	BW2132	**BW2132**	BR1020	**BW2002**	**BW1161**	BR0977	**BW1161**	BR0995	**BW2003**	BR0987	M_829DF1	BR0981	BR1017	BR0998	M_3032C0	M_302CA5
	BR0998	BR0999	M_302CA5	BR0977	BR0995	BR0988	BR0998	BR0975	BR1000	BR0980	BR0994	M_829DF1	BR1000	**BW1159**	**BW2128**	BR0981
	BR0980	**BW1159**	M_829DF1	BR1000	**BW2131**	M_2FA1E0	BR1020	BR0996	**BW2126**	BR0989	**BW2131**	BR0998	M_302CA5	**BW2001**	BR0988	BR0988
	BW2129	**BW2001**	**BW1159**	**BW2024**	BR0993	**BW2130**	**BW2003**	**BW1161**	BR0991	BR0975	**BW2130**	**BW1159**	**BW2127**	BR0989	**BW2131**	M_829DF1
	BR0989	M_3032C0	**BW1161**	BR0919	BR0983	BR0998	BR0997	BR0977	**BW2128**	BR1000	**BW1159**	BR0987	**BW2024**	BR0999	BR0993	BR0995
	BW2001	BR0981	BR0990	BR0990	BR0991	BR0995	**BW2126**	BR0978	BR0997	**BW1155**	BR0998	BR0980	BR0985	BR1020	**BW2126**	**BW2024**
	BW2131	BR0998	BR1021	BR1019	**BW1155**	BR0985	BR0999	**BW2131**	BR0983	BR0983	**BW2127**	**BW2001**	BR0993	M_3032C0	**BW1159**	M_3032C0
	BW2024	**BW2002**	BR1017	BR0996	M_2FA1E0	BR0919	BR1018	**BW2003**	BR0985	M_3032C0	M_2FA1E0	**BW1161**	**BW1161**	**BW2130**	BR0987	BR0919
	BR0977	BR0991	**BW2002**	BR0978	BR0981	BR0987	BR0977	BR0993	BR0992	BR0919	BR0992	**BW2003**	M_829DF1	BR0985	M_2FA1E0	**BW2001**
	M_3032C0	BR0978	BR0987	M_829DF1	BR0997	**BW1159**	M_302CA5	BR0985	**BW1159**	BR0997	BR0987	BR0984	BR0997	BR0994	BR0984	BR0994
	BR0994	BR0982	BR0994	**BW2132**	BR0919	BR1021	BR0975	BR0988	BR0975	**BW2131**	BR0981	**BW2126**	**BW2003**	**BW2128**	BR1021	BR0985
	BR0999	**BW2128**	BR0995	BR1017	BR0985	BR0989	BR0990	**BW1159**	**BW1161**	**BW2132**	BR1000	BR0994	**BW1159**	BR0987	**BW2127**	BR0982
	BR0982	BR1000	**BW2132**	BR0989	BR0978	BR1017	BR0987	BR0980	**BW2127**	**BW2130**	BR1020	BR1021	**BW2128**	BR0993	BR0982	**BW2130**
	BR0981	**BW2127**	**BW2126**	BR0982	BR0998	BR0999	BR0980	**BW2002**	BR0994	M_302CA5	M_3032C0	BR1020	**BW1155**	BR0984	BR0981	**BW1159**
	BR0985	BR1020	BR0984	BR0997	BR0980	M_302CA5	BR0985	BR0994	M_2FA1E0	**BW2002**	BR0997	M_3032C0	BR0999	**BW2126**	**BW2001**	BR1020
	BR0992	**BW2003**	BR0985	BR0994	**BW2003**	BR0992	**BW2001**	**BW2130**	BR0995	BR0994	BR0982	BR0990	BR0975	M_2FA1E0	**BW2132**	**BW1161**
	BW2003	BR0997	**BW2001**	**BW2131**	BR1021	BR0997	**BW2128**	**BW2129**	BR1021	M_829DF1	**BW2126**	**BW2132**	BR0998	BR1018	BR0977	BR0983
	BR1018	BR0992	BR0998	**BW1155**	BR0996	**BW2129**	BR0994	BR0999	**BW2129**	BR0985	BR0988	BR1018	**BW2131**	**BW2129**	BR1019	BR0977
	BR0978	BR0977	BR0997	**BW1159**	**BW2002**	BR0991	BR0982	M_2FA1E0	**BW2132**	**BW1159**	BR0999	BR1000	BR1021	**BW1161**	M_829DF1	BR0989
	BW1161	BR0985	BR0978	BR0985	BR0992	BR1019	M_829DF1	BR1018	**BW2001**	BR0978	**BW1161**	**BW2128**	BR0988	BR0995	**BW1155**	**BW1155**
	BW2127	BR0993	**BW2130**	BR0981	BR0990	**BW2132**	**BW2002**	BR0983	**BW1155**	**BW2024**	BR0980	**BW2131**	BR0919	BR0919	BR1020	BR0990
	BR0987	**BW2131**	BR1000	BR1020	BR1018	**BW2126**	BR0919	BR0987	BR0996	BR0988	BR0919	BR0992	BR0982	**BW2127**	BR0919	**BW2129**
	BR1020	BR1018	BR0983	BR0998	M_3032C0	BR1018	BR0984	**BW2126**	BR0982	BR1018	BR0978	BR0977	BR0987	**BW2003**	BR0989	**BW2132**
	BR0991	BR0975	BR0982	**BW2128**	**BW2129**	BR0983	BR0991	**BW2127**	BR0981	BR0977	**BW2002**	BR0996	BR0978	**BW2002**	BR0998	**BW2002**
	BR0975	BR0919	BR0999	BR0992	**BW2132**	**BW2024**	BR0993	**BW2001**	BR0980	**BW2001**	BR1018	**BW1155**	**BW2126**	BR0977	BR1017	**BW2128**
	BR0997	BR0987	**BW1155**	BR0984	BR0977	**BW1161**	BR0988	BR0981	BR1020	BR0981	BR0977	BR0997	**BW2132**	BR0982	M_302CA5	BR0980
	M_2FA1E0	M_2FA1E0	BR0919	**BW1161**	BR0989	**BW2001**	**BW2024**	M_829DF1	M_3032C0	BR0991	BR0985	BR0978	BR0989	BR0996	**BW2129**	BR0984
	BR0993	BR0994	BR0981	**BW2129**	**BW1159**	M_829DF1	BR0978	M_302CA5	BR0919	**BW2003**	**BW2001**	**BW2024**	M_2FA1E0	BR0975	BR0980	BR0998
WORST	BR0996	**BW1161**	**BW2024**	BR0980	BR0984	**BW1155**	**BW2132**	BR1019	*BR0998*	BR0999	BR0996	BR0985	**BW2001**	**BW2131**	**BW1161**	BR1021
MATE	BR0919	BR0996	BR0992	BR1021	*BR1020*	BR0978	*M_2FA1E0*	*BR1017*	*BR0989*	*M_2FA1E0*	BR0993	*BR0993*	BR0991	BR1000	BR1018	BR0992

SCOTT CREEK COHO BREEDING MATRIX, WEEK 4 **DATE: 27 JAN 2005**

SAMPLES COLLECTED/RECEIVED BY 24 JAN 2005
FEMALES LISTED ALONG TOP, MALES RANKED FROM BEST TO WORST MATE FOR EACH FEMALE
FIRST 5 FEMALES ARE WILD CAUGHT (FLOY TAG), REST ARE CAPTIVE BROODSTOCK
SHADED: AVOID THESE MATINGS IF POSSIBLE, USE ONLY AS LAST RESORT (RXY>0.25)
UNDERLINED/ITAL.: DO NOT MATE, RELATED AT RXY>0.50 (FULL SIBLING)
BOLD: WILD FISH, STREAM CAPTURED SPAWNING RETURN ALL OTHERS:CAPTIVE BROODSTOCK

F E M A L E S

	PW2379	**PW2377**	**PW2376**	**PW1062**	**PW1059**	PR 0948	PR 0925	PR 0924	PR 0923	PR 0922	PR 0921	PR 0920	PR 0919	PR 0918	PR 0917	PR 0916
BEST	**BW2003**	BR1017	BR0975	**BW2003**	BR1017	BR0991	**BW2003**	BR1019	BR0977	M_302CA5	BR0990	BR0992	BR1019	BR0992	BR1000	BR1017
MATE	M_302CA5	M_302CA5	BR0989	BR0975	BR1019	BR0999	BR0975	BR0980	BR0992	BR1019	BR1021	BR1020	BR0978	BR0984	BR0983	BR1019
	BR1017	BR1020	BR0995	M_302CA5	BR0996	BR0996	BR0999	BR1017	BR0983	BR0995	BR1019	BR0998	M_302CA5	M_3032C0	BR0992	M_302CA5
	BR0983	BR1018	**BW2134**	BR0990	**BW2134**	BR1018	BR0995	BR0990	BR0994	BR0982	BR0989	BR0982	BR0990	BR0982	BR0990	BR0983
	BR0996	BR0995	BR0996	BR0991	BR0989	**BW2003**	BR1000	M_302CA5	BR0980	BR0989	BR0983	BR1021	BR1017	BR1021	BR0995	BR1021
	BR0995	BR0994	BR0982	BR0988	BR0982	BR0987	BR0991	BR0978	BR1020	BR1017	BR1017	BR0995	M_829DF1	BR0990	M_3032C0	BR0995
	M_2FA1E0	BR0987	BR0919	BR0996	BR0998	BR0978	**BW2134**	**BW2132**	BR0981	BR0991	BR0991	BR0996	BR0977	BR0989	M_302CA5	BR1000
	BR1000	BR0982	M_3032C0	BR0982	BR0995	BR0975	BR0994	M_829DF1	BR0984	**BW2134**	M_302CA5	BR1017	BR1018	BR1020	BR1019	BR0990
M	BR1019	BR1019	BR0991	BR0999	BR0919	M_2FA1E0	BR0990	BR0992	M_3032C0	M_2FA1E0	**BW2132**	**BW2134**	BR0984	BR0997	**BW1155**	**BW1155**
A	BR0997	BR0992	BR0994	BR0987	BR0987	BR1019	BR0985	**BW1155**	BR1018	BR0983	BR0995	BR0984	BR0988	BR0919	BR1021	BR0992
L	M_829DF1	BR0998	M_2FA1E0	BR1017	BR1020	BR0997	BR0983	BR0988	BR1019	BR0988	BR0975	BR1019	BR0999	**BW1155**	BR0984	BR1018
E	BR0993	BR0990	BR1017	BR0995	BR0984	BR0993	BR0996	BR1021	BR0995	BR0919	**BW1155**	BR0990	BR0987	BR1000	BR0980	BR0989
S	BR0987	BR0996	**BW1159**	BR0994	BR0992	BR1017	BR0992	BR0981	BR0996	BR0999	BR0984	BR0993	BR0993	BR0991	**BW2003**	**BW2132**
	BR1021	BR0993	BR0999	BR0984	BR0980	BR1000	BR0978	BR0997	BR0990	BR0975	**BW2003**	BR0987	**BW2003**	BR0998	BR0997	BR0997
	BR1018	BR0975	BR1018	BR0983	BR0985	M_302CA5	BR0997	BR0983	BR1017	BR0981	M_829DF1	BR0980	BR1000	**BW2132**	BR1017	M_829DF1
	M_3032C0	BR1021	BR0998	BR1021	BR1021	BR0981	M_3032C0	BR0991	BR1000	M_829DF1	BR0994	BR0989	**BW2134**	BR0995	**BW2132**	BR0978
	BR1020	BR1000	**BW2003**	BR1000	BR0983	BR0988	BR0988	BR0998	M_302CA5	BR0998	**BW1159**	BR0975	BR0991	BR0975	**BW2134**	BR1020
	BR0990	BR0980	BR0980	**BW2132**	BR1000	M_829DF1	BR0993	**BW1159**	BR0985	**BW1159**	BR0998	BR1000	BR0997	BR0996	BR1020	M_3032C0
	BR0978	BR0977	BR0988	BR1018	M_3032C0	BR0995	**BW1159**	BR0989	BR0993	BR0987	M_2FA1E0	**BW1155**	BR0983	BR0977	BR0988	BR0998
	BR0980	BR0981	BR0981	BR0977	BR0981	M_3032C0	BR0987	BR0999	M_829DF1	BR0980	BR0992	BR0983	BR0985	BR0978	BR0977	BR0984
	BR0991	M_829DF1	BR1021	BR0997	M_829DF1	BR0919	M_2FA1E0	BR1020	BR0997	**BW2003**	BR0987	M_3032C0	BR0992	**BW2003**	BR0981	BR0980
	BR0989	BR0991	M_302CA5	BR1019	**BW1159**	BR0994	BR0984	M_3032C0	**BW2003**	BR0984	BR0981	BR0919	**BW1159**	BR0993	BR0989	**BW1159**
	BW1155	**BW2132**	BR0987	M_2FA1E0	M_302CA5	BR0985	BR1021	**BW2134**	**BW2134**	BR0994	BR1000	BR0997	BR0975	BR0985	BR0978	BR0999
	BR0982	BR0919	BR1020	M_829DF1	BR0975	BR0982	BR0982	BR0985	**BW1159**	BR1021	BR1020	**BW2132**	BR0994	BR0988	BR0996	**BW2134**
	BW2132	BR0999	BR0990	BR0993	BR0999	**BW1159**	BR0981	BR0994	**BW1155**	BR1020	M_3032C0	M_302CA5	M_2FA1E0	**BW1159**	BR0993	BR0977
	BR0999	**BW2134**	**BW2132**	BR0989	BR0978	BR1020	**BW2132**	BR0987	BR0999	M_3032C0	BR0997	BR0994	BR0995	BR0980	M_829DF1	BR0987
	BR0998	BR0997	BR0985	BR0980	BR0990	BR0983	BR0977	BR0993	BR0975	BR0990	BR0982	M_829DF1	BR1021	BR0994	BR1018	BR0991
	BR0975	BR0983	BR0977	BR1020	BR0994	BR0977	BR1019	BR0984	BR0998	**BW2132**	BR0988	BR0985	**BW2132**	BR0999	BR0998	BR0985
	BR0992	BR0984	BR1019	BR0978	BR0991	BR0989	M_829DF1	M_2FA1E0	BR1021	BR1018	BR0999	**BW1159**	**BW1155**	M_2FA1E0	BR0975	BR0981
	BR0984	BR0989	BR0993	**BW2134**	**BW2003**	**BW1155**	**BW1155**	BR1018	BR0988	BR1000	BR0980	BR0978	BR0996	BR1018	BR0999	BR0996
	BR0981	**BW2003**	**BW1155**	BR0998	M_2FA1E0	BR0990	BR1020	BR0995	BR0919	BR0992	**BW2134**	BR0988	BR0982	**BW2134**	BR0991	BR0994
	BR0985	M_3032C0	BR0997	BR0985	BR0997	**BW2132**	BR0919	BR0919	BR0982	BR0977	BR0919	BR1018	BR0981	BR0983	BR0982	BR0975
	BR0919	BR0985	BR1000	**BW1155**	BR0993	BR0980	BR0989	**BW2003**	BR0987	BR0996	BR0978	BR0977	BR0980	BR0987	BR0994	**BW2003**
	BR0977	M_2FA1E0	BR0984	BR0981	**BW2132**	BR0984	BR0998	BR0977	BR0978	**BW1155**	BR1018	BR0981	BR1020	BR0981	**BW1159**	BR0993
	BW1159	**BW1159**	BR0992	**BW1159**	BR0977	**BW2134**	BR1017	BR0982	**BW2132**	BR0997	BR0977	BR0991	M_3032C0	M_829DF1	BR0985	BR0982
	BW2134	**BW1155**	BR0983	BR0919	BR1018	BR0998	M_302CA5	BR0996	BR0989	BR0978	BR0985	**BW2003**	BR0919	M_302CA5	BR0987	M_2FA1E0
WORST	BR0988	BR0978	BR0978	M_3032C0	**BW1155**	BR1021	BR0980	BR0975	M_2FA1E0	BR0985	BR0996	BR0999	*BR0998*	BR1019	M_2FA1E0	BR0919
MATE	BR0994	BR0988	M_829DF1	*BR0992*	BR0988	BR0992	BR1018	BR1000	BR0991	*BR0993*	BR0993	*M_2FA1E0*	*BR0989*	*BR1017*	BR0919	*BR0988*

MATRIX CONTINUED **F E M A L E S**

	PR 0914	PR 0913	PR 0912	PR 0911	PR 0910	PR 0909	PR 0908	PR 0907	PR 0906	PR 0905	PR 0904	PR 0902	PR 0901	PR 0900	PB 0915
BEST	M_3032C0	**BW2003**	**BW1159**	**BW2134**	BR0987	**BW2003**	BR0991	BR1019	BR0995	**BW2132**	M_302CA5	BR0992	BR0977	BR0991	BR1020
MATE	BR0995	M_3032C0	BR0992	BR0987	BR1018	M_2FA1E0	BR0990	BR0995	BR1019	BR1017	BR1017	BR0984	BR0996	BR1018	BR0996
	BR1017	BR0984	BR0981	M_302CA5	M_2FA1E0	BR0996	M_2FA1E0	BR1021	BR1021	M_829DF1	BR1019	BR1021	BR0983	**BW2003**	BR1017
	BR1019	BR0996	BR1020	BR0988	M_302CA5	BR1018	**BW2003**	BR1017	M_302CA5	M_302CA5	BR0995	**BW1155**	BR0984	BR0987	BR1019
	BW1159	BR0981	M_3032C0	BR0994	**BW2003**	BR0993	M_302CA5	M_302CA5	BR1017	**BW1159**	BR1021	BR0990	**BW2003**	BR0999	BR0992
	BW1155	BR0994	BR0999	BR0975	BR0993	BR0975	BR0987	BR0990	M_829DF1	BR0980	BR0989	M_3032C0	M_3032C0	BR1019	BR0998
	BR1000	BR0990	BR0998	BR1017	BR0975	M_3032C0	BR0983	**BW2134**	**BW1159**	**BW1155**	**BW1159**	**BW1159**	BR0992	BR0975	BR0975
	BR0983	BR1020	BR0980	BR1000	BR0991	BR0977	BR0993	BR0989	BR0988	BR0977	BR0983	BR0995	BR0995	BR0978	BR1021
M	BR0981	BR0993	BR0977	BR0982	BR0995	BR0991	BR0978	BR0983	**BW2134**	BR1019	M_3032C0	BR0980	BR1000	BR0983	BR0982
A	BR0996	BR0982	BR0991	BR1019	BR0983	BR1019	BR1018	BR0988	BR0990	BR0978	**BW2134**	BR0983	BR0994	BR1017	BR0995
L	BR1021	BR0980	BR0994	M_829DF1	BR0988	BR0980	BR0975	M_829DF1	BR0984	BR1018	BR0990	BR0989	BR0975	BR0996	**BW1155**
E	BR0989	BR0975	BR0985	BR0999	BR0999	BR0988	**BW2132**	BR0980	**BW1155**	BR0989	BR1018	BR1020	BR1020	M_2FA1E0	BR1000
S	BR0992	BR1000	M_2FA1E0	BR0995	M_3032C0	BR0989	BR1019	BR0984	BR0983	BR1021	BR0998	**BW2134**	BR1018	**BW1159**	BR0983
	BR0998	BR0977	BR0919	BR0993	BR0977	BR1020	BR0997	**BW1155**	BR1000	BR0998	**BW1155**	BR0977	**BW1159**	BR0919	M_3032C0
	BW2134	BR0988	BR1019	BR0983	BR1000	M_302CA5	BR1000	**BW2132**	**BW2132**	BR0995	BR0997	**BW2132**	BR0985	BR0981	**BW2134**
	BR1020	M_2FA1E0	BR0983	BR0991	**BW2134**	M_829DF1	BR0999	BR0999	BR0998	**BW2134**	M_829DF1	BR0988	BR0980	M_3032C0	BR0984
	BW2003	BR0998	BR1017	**BW1155**	BR0919	**BW1159**	BR0995	**BW1159**	BR0980	BR0992	BR0980	BR0978	BR0990	BR0997	BR0997
	BR0997	BR0995	BR0989	M_2FA1E0	BR0990	BR0990	BR0988	M_3032C0	BR0989	BR0981	BR1020	**BW2003**	BR0993	**BW2134**	**BW1159**
	BR0999	BR0985	**BW2134**	BR0981	BR1019	BR1021	BR1017	BR0981	BR0977	BR0997	BR0981	BR0999	**BW2134**	M_302CA5	BR0980
	BR1018	BR0919	M_829DF1	BR0997	BR0996	BR1017	M_3032C0	BR0998	M_3032C0	BR0987	**BW2003**	BR1018	BR0997	BR0994	BR0989
	BR0977	BR0987	BR1018	BR0919	BR0978	BR0987	BR0977	BR0991	BR0994	BR0983	M_2FA1E0	BR1019	BR0999	BR0993	M_302CA5
	M_302CA5	**BW1159**	BR0978	BR0985	M_829DF1	**BW2134**	BR0996	BR0978	BR0999	BR0982	BR0987	BR0997	BR1021	BR0992	BR0919
	BR0975	BR1021	BR0984	BR0978	**BW2132**	BR0994	M_829DF1	BR0982	BR0982	M_3032C0	BR0977	BR0975	BR0987	BR1020	BR0994
	BR0990	BR0989	BR0987	BR0998	BR1017	BR0995	**BW2134**	BR1000	BR0981	BR0990	BR0975	BR1000	BR0989	BR0990	M_829DF1
	BR0987	BR1017	BR1000	BR0980	BR0989	**BW2132**	BR0992	BR1020	BR0985	BR0993	BR0919	BR0991	**BW1155**	M_829DF1	BR0977
	BR0980	BR0999	BR0975	**BW2003**	BR0982	BR0984	BR0994	**BW2003**	BR0992	BR0984	BR0996	M_2FA1E0	BR0988	**BW2132**	BR1018
	BR0985	M_302CA5	BR0996	BR1021	BR0997	BR0985	**BW1155**	BR0997	**BW2003**	M_2FA1E0	BR0994	BR0996	BR0919	BR0985	BR0990
	BR0994	BR0992	BR0997	BR0996	BR0994	BR0998	BR0982	BR0992	BR1018	BR1020	BR0985	BR0985	BR0998	BR1000	BR0978
	BR0982	**BW2134**	BR0988	BR0992	**BW1155**	BR0997	**BW1159**	BR0977	BR0978	BR0985	BR0982	BR0993	BR0982	BR0977	**BW2003**
	M_829DF1	BR0997	**BW1155**	BR0990	**BW1159**	BR0978	BR1020	BR0985	BR0987	BR0988	BR0991	M_829DF1	M_302CA5	BR0988	BR0987
	BR0919	BR0991	M_302CA5	BR1018	BR0985	BR1000	BR0989	BR0993	BR1020	BR1000	**BW2132**	BR0994	BR0991	BR0984	BR0981
	BR0984	BR1019	**BW2132**	M_3032C0	BR0981	BR0983	BR0919	BR1018	BR0991	BR0994	BR1000	BR0998	BR0981	BR0982	BR0985
	BR0991	**BW2132**	BR0993	**BW2132**	BR1020	BR0982	BR0984	BR0975	BR0975	BR0919	BR0984	BR0982	BR1019	BR0989	**BW2132**
	BR0993	BR1018	**BW2003**	BR0977	BR0998	BR0999	BR0981	BR0919	BR0997	**BW2003**	BR0999	BR0981	**BW2132**	BR0995	BR0993
	BR0988	BR0983	BR0990	BR0989	BR0992	**BW1155**	*BR0980*	BR0987	M_2FA1E0	BR0991	BR0992	BR0919	BR1017	**BW1155**	BR0991
	BR0978	M_829DF1	BR0995	**BW1159**	BR0984	BR0919	*BR0998*	M_2FA1E0	BR0993	BR0999	BR0993	BR1017	M_2FA1E0	BR0980	BR0988
WORST	**BW2132**	**BW1155**	BR1021	BR0984	BR0980	BR0981	*BR0985*	BR0994	BR0996	BR0996	BR0978	BR0987	BR0978	BR0998	M_2FA1E0
MATE	*M_2FA1E0*	BR0978	BR0982	*BR1020*	*BR1021*	BR0992	*BR1021*	BR0996	BR0919	*BR0975*	BR0988	M_302CA5	M_829DF1	*BR1021*	BR0999

SCOTT CREEK COHO BREEDING MATRIX, WEEK 5 **DATE: 4 FEB 2005**

SAMPLES COLLECTED, RECEIVED AND EXTRACTED BY 31 JAN 2005
FEMALES LISTED ALONG TOP, MALES RANKED FROM BEST TO WORST MATE FOR EACH FEMALE
FIRST 6 FEMALES ARE WILD CAUGHT (FLOY TAG), REST ARE BROODSTOCK
SHADED: AVOID THESE MATINGS IF POSSIBLE, USE ONLY AS LAST RESORT (RXY>0.25)
UNDERLINED/ITAL.: DO NOT MATE, RELATED AT RXY>0.50 (FULL SIBLING)
BOLD: WILD FISH, STREAM CAPTURED SPAWNING RETURN ALL OTHERS:CAPTIVE BROODSTOCK

F E M A L E S

	PW2382	**PW2381**	**PW2380**	**PW2377**	**PW2376**	**PW1076**	PR 0896	PR0897	PR 0948	PR 0925	PR 0924	PR 0923	PR 0922	PR 0921	PR 0920	PR 0919	PR 0918	PR 0917
BEST	BR0996	BR0992	**BW2133**	M_302CA!	BR0975	BR0992	BR1019	BR0992	BR0991	**BW2003**	BR1019	BR0977	M_302CA!	BR0990	BR0992	BR1019	BR0992	BR0983
MATE	BR0975	BR0998	**BW1159**	BR1020	BR0995	**BW2134**	BR1018	**BW1155**	BR0999	BR0975	**BW2133**	BR0992	BR1019	BR1021	BR1020	BR0978	BR0984	BR0992
	M_3032C(	**BW1155**	BR0995	BR1018	**BW2134**	BR0983	**BW2003**	BR0998	BR0996	BR0999	BR0990	BR0983	BR0995	BR1019	BR0998	**BW2133**	M_3032C(	BR0990
	BR0990	BR1019	M_302CA!	BR0995	BR0996	BR0995	BR0978	BR0996	BR1018	BR0995	M_302CA!	BR0994	BR0982	BR0983	BR0982	M_302CA!	BR0982	**BW2133**
	BR0992	BR1021	BR1019	BR0994	BR0982	**BW1155**	M_829DF'	M_3032C(	**BW2003**	BR0991	BR0978	BR1020	BR0991	BR0991	BR1021	BR0990	BR1021	BR0995
	BR0919	**BW2132**	**BW2134**	BR0987	BR0919	BR1019	BR0977	BR0983	BR0987	**BW2134**	**BW2132**	BR0981	**BW2134**	M_302CA!	BR0995	M_829DF'	BR0990	M_3032C0
	BR0983	**BW2134**	BR1021	BR0982	M_3032C(	BR0984	BR0988	BR0919	BR0978	BR0994	M_829DF'	**BW2133**	M_2FA1E(	**BW2132**	BR0996	BR0977	BR1020	M_302CA5
	BR1021	**BW2133**	**BW2132**	BR1019	BR0991	BR0978	M_302CA!	BR0995	BR0975	BR0990	BR0992	BR0984	BR0983	**BW2133**	**BW2134**	BR1018	BR0997	BR1019
M	**BW2003**	BR0987	M_829DF'	BR0992	BR0994	**BW2133**	BR0999	BR1019	M_2FA1E(	BR0985	**BW1155**	M_3032C(	BR0988	BR0995	BR0984	BR0984	BR0919	**BW1155**
A	BR0998	M_302CA!	BR0982	BR0998	M_2FA1E(	BR1021	BR0990	**BW2133**	BR1019	BR0983	BR0988	BR1018	BR0919	BR0975	BR1019	BR0988	**BW1155**	BR1021
L	BR1019	BR0990	**BW1155**	BR0990	**BW1159**	BR0988	BR0993	M_829DF'	BR0997	BR0996	BR1021	BR1019	BR0999	**BW1155**	BR0990	BR0999	BR0991	BR0984
E	BR0987	BR0995	M_3032C(	BR0996	BR0999	M_829DF'	BR0987	**BW2134**	BR0993	BR0992	BR0981	BR0995	BR0975	BR0984	BR0993	BR0987	BR0998	**BW2003**
S	BR0984	BR0978	BR0990	BR0993	BR1018	BR0990	BR0975	BR0987	M_302CA!	BR0978	BR0997	BR0996	BR0981	**BW2003**	BR0987	BR0993	**BW2132**	BR0997
	BR0991	M_829DF'	BR0998	BR0975	BR0998	**BW2132**	BR0991	BR0975	BR0981	BR0997	BR0983	BR0990	M_829DF'	M_829DF'	BR0975	**BW2003**	BR0995	**BW2132**
	BR1020	BR0982	BR0991	BR1021	**BW2003**	BR0993	BR0997	BR0978	BR0988	M_3032C(	BR0991	M_302CA!	BR0998	BR0994	**BW1155**	**BW2134**	BR0975	**BW2134**
	BR0995	**BW1159**	BR0975	BR0977	BR0988	M_302CA!	BR0983	BR0982	M_829DF'	BR0988	BR0985	BR0985	**BW1159**	**BW1159**	BR0983	BR0991	BR0996	BR1020
	M_829DF'	BR0975	BR0984	BR0981	BR0981	BR0975	BR0994	BR1021	BR0995	BR0993	**BW1159**	BR0993	BR0987	BR0998	M_3032C(	BR0997	BR0977	BR0988
	BW2132	BR1020	BR0981	M_829DF'	BR1021	BR0998	**BW2134**	M_302CA!	M_3032C(	**BW1159**	BR0999	M_829DF'	**BW2003**	M_2FA1E(	BR0919	BR0983	BR0978	BR0977
	BW1159	M_3032C(	BR0978	BR0991	M_302CA!	M_3032C(	**BW2133**	BR0984	BR0919	BR0987	BR1020	BR0997	BR0984	BR0992	BR0997	BR0985	**BW2003**	BR0981
	BR0988	BR0919	BR0999	**BW2132**	BR0987	BR0999	BR0984	BR0990	BR0994	M_2FA1E(	M_3032C(	**BW2003**	BR0994	BR0987	**BW2132**	BR0992	BR0993	BR0978
	BW2133	BR0983	BR0919	BR0919	BR1020	BR0985	BR0996	**BW2132**	BR0985	BR0984	**BW2134**	**BW2134**	BR1021	BR0981	M_302CA!	**BW1159**	BR0985	BR0996
	BR1018	BR0984	BR1018	BR0999	BR0990	BR0982	BR0985	**BW1159**	BR0982	**BW2133**	BR0985	**BW1159**	BR1020	BR1020	BR0994	BR0975	BR0988	BR0993
	BR0994	BR0996	BR0983	**BW2134**	**BW2132**	BR1020	M_2FA1E(	BR1020	**BW1159**	BR1021	BR0994	**BW1155**	M_3032C(	M_3032C(	M_829DF'	BR0994	**BW2133**	M_829DF1
	BW1155	BR0993	BR0977	BR0997	BR0985	BR0919	**BW2132**	BR0981	BR1020	BR0982	BR0987	BR0999	BR0990	BR0997	BR0985	M_2FA1E(	**BW1159**	BR1018
	BR0982	BR0991	BR0987	BR0977	BR0977	BR0994	BR0981	BR0997	BR0983	BR0981	BR0993	BR0975	**BW2133**	BR0982	**BW1159**	BR0995	BR0994	BR0998
	M_302CA!	BR0988	M_2FA1E(	BR0984	BR1019	**BW2003**	**BW1159**	BR0991	BR0977	**BW2132**	BR0984	BR0998	**BW2132**	BR0988	**BW2133**	BR1021	BR0999	BR0975
	BR0977	BR1018	BR0997	**BW2003**	BR0993	BR0991	BR0992	**BW2003**	**BW1155**	BR0977	M_2FA1E(	BR1021	BR1018	BR0999	BR0978	**BW2132**	M_2FA1E(	BR0999
	BR0997	BR0985	BR0985	M_3032C(	**BW1155**	BR0997	BR0995	BR0993	BR0990	BR1019	BR1018	BR0988	BR0992	**BW2134**	BR0988	**BW1155**	BR1018	BR0991
	BR0985	BR0999	BR0994	BR0985	BR0997	BR0996	BR1021	BR0994	**BW2133**	M_829DF'	BR0995	BR0919	BR0977	BR0919	BR1018	BR0996	**BW2134**	BR0982
	BR0981	BR0997	BR0988	M_2FA1E(	BR0984	BR0987	BR0982	BR0999	**BW2132**	**BW1155**	BR0919	BR0982	BR0996	BR0978	BR0977	BR0982	BR0983	BR0994
	BW2134	BR0981	BR1020	**BW1159**	BR0992	**BW1159**	**BW1155**	BR0985	BR0984	BR1020	**BW2003**	BR0987	**BW1155**	BR1018	BR0981	BR0981	BR0987	**BW1159**
	BR0993	BR0977	BR0996	**BW2133**	BR0983	BR0977	BR1020	M_2FA1E(	**BW2134**	BR0919	BR0977	BR0978	BR0997	BR0977	BR0991	BR1020	BR0981	BR0985
	BR0999	BR0994	BR0992	**BW1155**	BR0978	M_2FA1E(	M_3032C(	BR1018	BR0998	BR0998	BR0982	**BW2132**	BR0978	BR0985	**BW2003**	M_3032C(	M_829DF'	BR0987
WORST	BR0978	**BW2003**	**BW2003**	BR0978	M_829DF'	BR0981	BR0919	BR0988	BR1021	M_302CA!	BR0996	M_2FA1E(	BR0985	BR0996	BR0999	BR0919	M_302CA!	M_2FA1E0
MATE	M_2FA1E(	M_2FA1E(	BR0993	BR0988	***BW2133***	BR1018	*BR0998*	BR0977	BR0992	BR1018	BR0975	BR0991	*BR0993*	BR0993	*M_2FA1E(*	*BR0998*	BR1019	BR0919

MATRIX CONTINUED F E M A L E S

	PR 0916	PR 0914	PR 0913	PR 0912	PR 0911	PR 0910	PR 0909	PR 0908	PR 0907	PR 0906	PR 0905	PR 0904	PR 0902	PR 0901	PR 0900	PW1098	PB 0915
BEST	BR1019	M_3032C(	**BW2003**	**BW1159**	**BW2134**	BR0987	**BW2003**	BR0991	BR1019	BR0995	**BW2132**	M_302CA!	BR0992	BR0977	BR0991	BR0988	BR1020
MATE	M_302CA!	BR0995	M_3032C(	BR0992	BR0987	BR1018	M_2FA1E(	BR0990	BR0995	BR1019	**BW2133**	BR1019	BR0984	BR0996	BR1018	**BW2003**	BR0996
	BR0983	BR1019	BR0984	**BW2133**	M_302CA!	M_2FA1E(	BR0996	M_2FA1E(	BR1021	BR1021	M_829DF'	BR0995	BR1021	BR0983	**BW2003**	BR0983	BR1019
	BR1021	**BW1159**	BR0996	BR0981	BR0988	M_302CA!	BR1018	**BW2003**	M_302CA!	**BW2133**	M_302CA!	BR1021	**BW1155**	BR0984	BR0987	BR1021	BR0992
	BR0995	**BW1155**	BR0981	BR1020	BR0994	**BW2003**	BR0993	M_302CA!	BR0990	M_302CA!	**BW1159**	**BW1159**	BR0990	**BW2003**	BR0999	**BW1155**	BR0998
	BW2133	BR0983	BR0994	M_3032C(	BR0975	BR0993	BR0975	BR0987	**BW2133**	M_829DF'	**BW1155**	BR0983	M_3032C(	M_3032C(	BR1019	BR0978	BR0975
	BR0990	BR0981	BR0990	BR0999	BR0982	BR0975	M_3032C(	BR0983	**BW2134**	**BW1159**	BR0977	M_3032C(	**BW1159**	BR0992	BR0975	BR0992	BR1021
	BW1155	BR0996	BR1020	BR0998	BR1019	BR0991	BR0977	BR0993	BR0983	BR0988	BR1019	**BW2134**	BR0995	BR0995	BR0978	BR0991	BR0982
M	BR0992	BR1021	BR0993	BR0977	M_829DF'	BR0995	BR0991	BR0978	BR0988	**BW2134**	BR0978	BR0990	BR0983	BR0994	BR0983	BR0999	BR0995
A	BR1018	BR0992	BR0982	BR0991	**BW2133**	BR0983	BR1019	BR1018	M_829DF'	BR0990	BR1018	BR1018	BR1020	BR0975	BR0996	BR0984	**BW1155**
L	**BW2132**	BR0998	BR0975	BR0994	BR0999	BR0988	BR0988	BR0975	BR0984	BR0984	BR1021	BR0998	**BW2134**	BR1020	M_2FA1E(	BR0982	BR0983
E	BR0997	**BW2134**	BR0977	BR0985	BR0995	BR0999	BR1020	**BW2132**	**BW1155**	**BW1155**	BR0998	**BW1155**	BR0977	BR1018	**BW1159**	BR0919	M_3032C0
S	M_829DF'	BR1020	BR0988	M_2FA1E(	BR0993	M_3032C(	M_302CA!	BR1019	**BW2132**	BR0983	BR0995	BR0997	**BW2132**	**BW1159**	BR0919	**BW2133**	**BW2134**
	BR0978	**BW2003**	M_2FA1E(	BR0919	BR0983	BR0977	M_829DF'	BR0997	BR0999	**BW2132**	**BW2134**	**BW2133**	BR0988	BR0985	BR0981	BR0993	BR0984
	BR1020	BR0997	BR0998	BR1019	BR0991	**BW2134**	**BW1159**	BR0999	**BW1159**	BR0998	BR0992	M_829DF'	BR0978	**BW2133**	M_3032C(	BR0997	BR0997
	M_3032C(	**BW2133**	BR0995	BR0983	**BW1155**	BR0919	BR0990	BR0995	M_3032C(	BR0977	BR0981	BR1020	**BW2003**	BR0990	BR0997	**BW1159**	**BW1159**
	BR0998	BR0999	BR0985	**BW2134**	M_2FA1E(	BR0990	BR1021	BR0988	BR0981	M_3032C(	BR0997	BR0981	BR0999	BR0993	**BW2134**	M_3032C(	M_302CA5
	BR0984	BR1018	BR0919	M_829DF'	BR0981	BR1019	BR0987	M_3032C(	BR0998	BR0994	BR0987	**BW2003**	BR1018	**BW2134**	M_302CA!	BR0996	BR0919
	BW1159	BR0977	BR0987	BR1018	BR0997	BR0996	**BW2134**	BR0977	BR0991	BR0999	BR0983	M_2FA1E(	BR1019	BR0997	BR0994	BR1020	BR0994
	BR0999	M_302CA!	**BW1159**	BR0978	BR0919	BR0978	BR0994	BR0996	BR0978	BR0982	BR0982	BR0987	BR0997	BR0999	BR0993	BR0995	M_829DF1
	BW2134	BR0975	BR1021	BR0984	BR0985	M_829DF'	BR0995	M_829DF'	BR0982	BR0981	M_3032C(	BR0977	**BW2133**	BR1021	BR0992	M_2FA1E(	**BW2133**
	BR0977	BR0990	BR0999	BR0987	BR0978	**BW2132**	**BW2132**	**BW2133**	BR1020	BR0985	BR0990	BR0975	BR0975	BR0987	BR1020	BR0981	BR0977
	BR0987	BR0987	M_302CA!	BR0975	BR0998	BR0982	BR0984	**BW2134**	**BW2003**	BR0992	BR0993	BR0919	BR0991	**BW1155**	BR0990	BR0990	BR1018
	BR0991	BR0985	BR0992	BR0996	**BW2003**	BR0997	BR0985	BR0992	BR0997	**BW2003**	BR0984	BR0996	M_2FA1E(	BR0988	M_829DF'	**BW2132**	BR0990
	BR0985	BR0994	**BW2134**	BR0997	BR1021	BR0994	BR0998	BR0994	BR0992	BR1018	M_2FA1E(	BR0994	BR0996	BR0919	**BW2132**	M_829DF'	BR0978
	BR0981	BR0982	BR0997	BR0988	BR0996	**BW2133**	BR0997	**BW1155**	BR0977	BR0978	BR1020	BR0985	BR0985	BR0998	BR0985	BR0998	**BW2003**
	BR0996	M_829DF'	BR0991	**BW1155**	BR0992	**BW1155**	**BW2133**	BR0982	BR0985	BR0987	BR0985	BR0982	BR0993	BR0982	BR0977	BR0975	BR0987
	BR0994	BR0919	BR1019	M_302CA!	BR0990	**BW1159**	BR0978	**BW1159**	BR0993	BR1020	BR0988	BR0991	M_829DF'	M_302CA!	BR0988	BR1018	BR0981
	BR0975	BR0984	**BW2132**	**BW2132**	BR1018	BR0985	BR0983	BR1020	BR1018	BR0991	BR0994	**BW2132**	BR0994	BR0991	BR0984	BR0977	BR0985
	BW2003	BR0991	BR1018	BR0993	M_3032C(	BR0981	BR0982	BR0919	BR0975	BR0975	BR0919	BR0984	BR0998	BR0981	BR0982	BR1019	**BW2132**
	BR0993	BR0993	BR0983	**BW2003**	**BW2132**	BR1020	BR0999	BR0984	BR0919	BR0997	**BW2003**	BR0999	BR0982	BR1019	BR0995	BR0987	BR0993
	BR0982	BR0988	M_829DF'	BR0990	BR0977	BR0998	**BW1155**	BR0981	BR0987	M_2FA1E(	BR0991	BR0992	BR0981	**BW2132**	**BW2133**	**BW2134**	BR0991
	M_2FA1E(	BR0978	**BW2133**	BR0995	**BW1159**	BR0992	BR0919	*BR0998*	M_2FA1E(	BR0993	BR0999	BR0993	BR0919	M_2FA1E(	**BW1155**	M_302CA!	BR0988
WORST	BR0919	**BW2132**	**BW1155**	BR1021	BR0984	BR0984	BR0981	*BR0985*	BR0994	BR0996	BR0996	BR0978	BR0987	BR0978	BR0998	BR0985	M_2FA1E0
MATE	*BR0988*	*M_2FA1E(*	BR0978	BR0982	*BR1020*	*BR1021*	BR0992	*BR1021*	BR0996	BR0919	*BR0975*	BR0988	M_302CA!	M_829DF'	*BR1021*	BR0994	BR0999

SCOTT CREEK COHO BREEDING MATRIX, WEEK 6 **DATE: 11 FEB 2005**

SAMPLES COLLECTED, RECEIVED AND EXTRACTED BY 7 FEB 2005
FEMALES LISTED ALONG TOP, MALES RANKED FROM BEST TO WORST MATE FOR EACH FEMALE
FIRST 4 FEMALES ARE WILD CAUGHT (FLOY TAG), REST ARE BROODSTOCK
SHADED: AVOID THESE MATINGS IF POSSIBLE, USE ONLY AS LAST RESORT (RXY>0.25)
UNDERLINED/ITAL.: DO NOT MATE, RELATED AT RXY>0.50 (FULL SIBLING)
BOLD: WILD FISH, STREAM CAPTURED SPAWNING RETURN ALL OTHERS:CAPTIVE BROODSTOCK

F E M A L E S

	PW1076	**PW2376**	**PW2380**	**PW2381**	PR0897	PR0943	PB 0915	PR 0900	PR 0901	PR 0902	PR 0904	PR 0905	PR 0906	PR 0907
BEST	BR0992	BR0975	**BW2133**	BR0992	BR0992	BR1019	BR1020	BR0991	BR0977	BR0992	M_302CA5	**BW2132**	BR0995	BR1019
MATE	**BW2134**	**BW2006**	**BW1159**	BR0998	**BW1155**	BR0997	BR0996	BR1018	BR0996	BR0984	BR1019	**BW2133**	BR1019	BR0995
	BR0983	BR0995	BR0995	**BW1155**	BR0998	M_302CA5	BR1019	**BW2003**	BR0983	BR1021	BR0995	M_829DF1	BR1021	BR1021
	BR0995	**BW2134**	M_302CA5	BR1019	BR0996	M_829DF1	BR0992	BR0987	BR0984	**BW1155**	BR1021	M_302CA5	**BW2133**	M_302CA5
	BW1155	BR0996	BR1019	BR1021	M_3032C0	**BW2003**	BR0998	BR0999	**BW2003**	BR0990	**BW1159**	**BW1159**	M_302CA5	BR0990
	BR1019	BR0919	**BW2134**	**BW2132**	BR0983	BR1018	BR0975	BR1019	M_3032C0	M_3032C0	BR0983	**BW1155**	M_829DF1	**BW2133**
	BR0984	M_3032C0	**BW2022**	**BW2134**	BR0919	BR0977	BR1021	BR0975	BR0992	**BW1159**	M_3032C0	BR0977	**BW1159**	**BW2134**
	BR0978	BR0991	BR1021	**BW2133**	BR0995	**BW2022**	BR0995	**BW2006**	BR0995	BR0995	**BW2134**	BR1019	BR0988	BR0983
M	**BW2133**	BR0994	**BW2132**	BR0987	BR1019	BR0993	**BW1155**	BR0978	BR0994	BR0983	BR0990	BR0978	**BW2134**	BR0988
A	BR1021	M_2FA1E0	M_829DF1	M_302CA5	**BW2133**	BR1021	BR0983	BR0983	BR0975	**BW2022**	BR1018	BR1018	BR0990	M_829DF1
L	BR0988	**BW1159**	**BW1155**	BR0990	M_829DF1	BR0981	M_3032C0	BR0996	BR1020	BR1020	BR0998	BR1021	BR0984	BR0984
E	M_829DF1	BR0999	M_3032C0	BR0995	**BW2134**	**BW1155**	**BW2134**	M_2FA1E0	BR1018	**BW2134**	**BW1155**	BR0998	**BW1155**	**BW1155**
S	BR0990	BR1018	BR0990	**BW2006**	BR0987	BR0991	BR0984	**BW1159**	**BW1159**	BR0977	BR0997	BR0995	BR0983	**BW2132**
	BW2132	BR0998	BR0998	BR0978	BR0975	BR1020	BR0997	BR0919	BR0985	**BW2132**	**BW2133**	**BW2134**	**BW2132**	BR0999
	BR0993	**BW2003**	BR0991	M_829DF1	BR0978	BR0990	**BW1159**	BR0981	**BW2133**	BR0988	M_829DF1	BR0992	BR0998	**BW1159**
	M_302CA5	BR0988	BR0975	**BW1159**	BR1021	**BW2006**	M_302CA5	**BW2022**	BR0990	BR0978	BR1020	BR0981	**BW2022**	M_3032C0
	BW2022	BR0981	BR0984	BR0975	M_302CA5	BR0978	BR0919	M_3032C0	**BW2022**	**BW2003**	BR0981	BR0997	BR0977	BR0981
	BR0975	**BW2022**	BR0981	BR1020	BR0984	BR0983	BR0994	BR0997	BR0993	BR0999	**BW2003**	BR0987	M_3032C0	BR0998
	BR0998	BR1021	BR0978	M_3032C0	**BW2022**	M_2FA1E0	M_829DF1	**BW2134**	**BW2134**	BR1018	M_2FA1E0	BR0983	BR0994	BR0991
	M_3032C0	M_302CA5	BR0999	BR0919	BR0990	BR0987	**BW2133**	M_302CA5	BR0997	BR1019	BR0987	**BW2022**	BR0999	BR0978
	BR0999	BR0987	BR0919	BR0983	**BW2132**	**BW1159**	BR0977	BR0994	BR0999	BR0997	BR0977	M_3032C0	BR0981	BR1020
	BR0985	BR1020	BR1018	**BW2022**	**BW1159**	BR0995	BR1018	BR0993	BR1021	**BW2133**	BR0975	BR0990	BR0985	**BW2003**
	BR1020	BR0990	BR0983	BR0984	BR1020	BR0994	BR0990	BR0992	BR0987	BR0975	BR0919	BR0993	BR0992	BR0997
	BR0919	**BW2132**	**BW2006**	BR0996	BR0981	**BW2132**	BR0978	BR1020	**BW1155**	BR0991	BR0996	BR0984	**BW2003**	BR0992
	BR0994	BR0985	BR0977	BR0993	BR0997	BR0999	**BW2003**	BR0990	BR0988	M_2FA1E0	BR0994	M_2FA1E0	BR1018	BR0977
	BW2003	BR0977	BR0987	BR0991	**BW2006**	**BW2133**	**BW2006**	M_829DF1	BR0919	BR0996	**BW2006**	BR1020	BR0978	BR0985
	BR0991	BR1019	M_2FA1E0	BR0988	BR0991	BR0985	BR0987	**BW2132**	BR0998	BR0985	BR0985	BR0985	BR0987	BR0993
	BR0997	BR0993	BR0997	BR1018	**BW2003**	BR0988	BR0981	BR0985	**BW2006**	BR0993	BR0991	BR0988	BR1020	BR1018
	BR0996	**BW1155**	BR0985	BR0985	BR0993	BR0998	**BW2022**	BR0977	M_302CA5	**BW2006**	**BW2022**	BR0994	BR0991	BR0975
	BW2006	BR0997	BR0994	BR0999	BR0994	BR0984	BR0985	BR0988	BR0991	M_829DF1	**BW2132**	BR0919	BR0975	BR0919
	BR0987	BR0984	BR0988	BR0997	BR0999	M_3032C0	**BW2132**	BR0984	BR0981	BR0994	BR0984	**BW2006**	BR0997	BR0987
	BW1159	BR0992	BR1020	BR0981	BR0985	BR0992	BR0993	BR0995	BR1019	BR0998	BR0999	**BW2003**	M_2FA1E0	M_2FA1E0
	BR0977	BR0983	BR0996	BR0977	M_2FA1E0	BR0996	BR0991	**BW2133**	**BW2132**	BR0981	BR0992	BR0991	**BW2006**	**BW2022**
	M_2FA1E0	BR0978	BR0992	BR0994	BR1018	**BW2134**	BR0988	**BW1155**	M_2FA1E0	BR0919	BR0993	BR0999	BR0993	BR0994
WORST	BR0981	M_829DF1	**BW2003**	**BW2003**	BR0988	BR0975	M_2FA1E0	BR0998	BR0978	BR0987	BR0978	BR0996	BR0996	**BW2006**
MATE	BR1018	***BW2133***	BR0993	M_2FA1E0	BR0977	BR0919	BR0999	*BR1021*	M_829DF1	M_302CA5	BR0988	*BR0975*	BR0919	BR0996

MATRIX CONTINUED **F E M A L E S**

	PR 0909	PR 0910	PR 0911	PR 0913	PR 0914	PR 0916	PR 0918	PR 0919	PR 0921	PR 0922	PR 0923	PR 0925	PR 0948
BEST	**BW2003**	BR0987	**BW2134**	**BW2003**	M_3032C0	BR1019	BR0992	BR1019	BR0990	M_302CA5	BR0977	**BW2003**	BR0991
MATE	M_2FA1E0	BR1018	BR0987	M_3032C0	BR0995	M_302CA5	BR0984	BR0978	BR1021	BR1019	BR0992	BR0975	BR0999
	BR0996	M_2FA1E0	M_302CA5	BR0984	BR1019	BR0983	M_3032C0	**BW2022**	BR1019	BR0995	BR0983	BR0999	**BW2022**
	BR1018	M_302CA5	BR0988	BR0996	**BW1159**	BR1021	BR1021	**BW2133**	BR0983	BR0991	BR0994	BR0995	BR0996
	BR0993	**BW2003**	**BW2006**	BR0981	**BW1155**	BR0995	BR0990	M_302CA5	BR0991	**BW2134**	BR1020	BR0991	BR1018
	BR0975	BR0993	BR0994	BR0994	BR0983	**BW2133**	BR1020	BR0990	M_302CA5	M_2FA1E0	BR0981	**BW2134**	**BW2003**
	M_3032C0	BR0975	BR0975	BR0990	BR0981	BR0990	BR0997	M_829DF1	**BW2132**	BR0983	**BW2133**	BR0994	BR0987
	BR0977	**BW2006**	BR1019	BR1020	BR0996	**BW1155**	BR0919	BR0977	**BW2133**	**BW2006**	BR0984	**BW2006**	**BW2006**
M	BR0991	BR0991	M_829DF1	BR0993	BR1021	**BW2022**	**BW1155**	BR1018	BR0995	BR0988	M_3032C0	BR0990	BR0978
A	BR1019	BR0995	**BW2133**	BR0975	BR0992	BR0992	BR0991	BR0984	BR0975	BR0919	BR1018	BR0985	BR0975
L	BR0988	**BW2022**	BR0999	BR0977	BR0998	BR1018	BR0998	BR0988	**BW1155**	BR0999	BR1019	BR0983	M_2FA1E0
E	**BW2022**	BR0983	BR0995	BR0988	**BW2134**	**BW2132**	**BW2132**	BR0999	BR0984	BR0975	BR0995	BR0996	BR1019
S	BR1020	BR0988	BR0993	M_2FA1E0	BR1020	BR0997	BR0995	BR0987	**BW2003**	BR0981	BR0996	BR0992	BR0997
	M_302CA5	BR0999	BR0983	BR0998	**BW2003**	M_829DF1	BR0975	BR0993	M_829DF1	M_829DF1	BR0990	BR0978	BR0993
	M_829DF1	M_3032C0	BR0991	BR0995	BR0997	BR0978	BR0996	**BW2003**	BR0994	BR0998	M_302CA5	BR0997	M_302CA5
	BW1159	BR0977	**BW1155**	BR0985	**BW2133**	BR1020	BR0977	**BW2134**	**BW1159**	**BW1159**	BR0985	M_3032C0	BR0981
	BR0990	**BW2134**	M_2FA1E0	BR0919	BR0999	M_3032C0	BR0978	BR0991	BR0998	BR0987	BR0993	BR0988	BR0988
	BR1021	BR0919	BR0981	BR0987	BR1018	BR0998	**BW2003**	BR0997	M_2FA1E0	**BW2003**	**BW2022**	BR0993	M_829DF1
	BR0987	BR0990	BR0997	**BW1159**	**BW2022**	BR0984	BR0993	BR0983	BR0992	BR0984	M_829DF1	**BW2022**	BR0995
	BW2134	BR1019	BR0919	BR1021	BR0977	**BW1159**	BR0985	BR0985	BR0987	BR0994	BR0997	**BW1159**	M_3032C0
	BR0994	BR0996	BR0985	**BW2006**	M_302CA5	BR0999	BR0988	BR0992	BR0981	BR1021	**BW2003**	BR0987	BR0919
	BR0995	BR0978	BR0978	BR0999	BR0975	**BW2134**	**BW2133**	**BW1159**	BR1020	BR1020	**BW2134**	M_2FA1E0	BR0994
	BW2006	M_829DF1	BR0998	M_302CA5	BR0990	BR0977	**BW1159**	BR0975	M_3032C0	M_3032C0	**BW1159**	BR0984	BR0985
	BW2132	**BW2132**	**BW2022**	BR0992	BR0987	BR0987	**BW2006**	BR0994	BR0997	BR0990	**BW1155**	**BW2133**	**BW1159**
	BR0984	BR0997	**BW2003**	**BW2134**	BR0985	BR0991	BR0994	M_2FA1E0	**BW2006**	**BW2133**	BR0999	BR1021	BR1020
	BR0985	BR0994	BR1021	BR0997	BR0994	BR0985	**BW2022**	BR0995	BR0988	**BW2132**	BR0975	BR0981	BR0983
	BR0998	**BW2133**	BR0996	BR0991	**BW2006**	BR0981	BR0999	BR1021	BR0999	BR1018	BR0998	**BW2132**	BR0977
	BR0997	**BW1155**	BR0992	BR1019	M_829DF1	BR0996	M_2FA1E0	**BW2132**	**BW2134**	BR0992	BR1021	BR0977	**BW1155**
	BW2133	**BW1159**	BR0990	**BW2132**	BR0919	BR0994	BR1018	**BW2006**	BR0919	BR0977	BR0988	BR1019	BR0990
	BR0978	BR0985	BR1018	**BW2022**	BR0984	BR0975	**BW2134**	**BW1155**	BR0978	BR0996	BR0919	M_829DF1	**BW2133**
	BR0983	BR0981	M_3032C0	BR1018	BR0991	**BW2003**	BR0983	BR0996	BR1018	**BW1155**	BR0987	**BW1155**	**BW2132**
	BR0999	BR1020	**BW2132**	BR0983	BR0993	BR0993	BR0987	BR0981	BR0977	**BW2022**	BR0978	BR1020	BR0984
	BW1155	BR0998	BR0977	M_829DF1	BR0988	**BW2006**	BR0981	BR1020	BR0985	BR0997	**BW2132**	BR0919	**BW2134**
	BR0919	BR0992	**BW1159**	**BW2133**	BR0978	M_2FA1E0	M_829DF1	M_3032C0	**BW2022**	BR0978	M_2FA1E0	BR0998	BR0998
WORST	BR0981	BR0984	BR0984	**BW1155**	**BW2132**	BR0919	M_302CA5	BR0919	BR0996	BR0985	**BW2006**	M_302CA5	BR1021
MATE	BR0992	*BR1021*	*BR1020*	BR0978	*M_2FA1E0*	*BR0988*	BR1019	*BR0998*	BR0993	*BR0993*	BR0991	BR1018	BR0992

SCOTT CREEK COHO BREEDING MATRIX, WEEK 7 (FINAL WEEK) **DATE: 20 FEB 2005**

SAMPLES COLLECTED, RECEIVED AND EXTRACTED BY 16 FEB 2005
FEMALES LISTED ALONG TOP, MALES RANKED FROM BEST TO WORST MATE FOR EACH FEMALE
FIRST 2 FEMALES ARE WILD CAUGHT (FLOY TAG), REST ARE BROODSTOCK
SHADED AVOID THESE MATINGS IF POSSIBLE, USE ONLY AS LAST RESORT (RXY>0.25)
UNDERLINED/ITAL.: DO NOT MATE, RELATED AT RXY>0.50 (FULL SIBLING)
BOLD: WILD FISH, STREAM CAPTURED SPAWNING RETURN ALL OTHERS:CAPTIVE BROODSTOCK

	F E M A L E S									
	PR2479	**PR0897**	PR 0948	PR 0925	PR 0923	PR 0922	PR 0921	PR 0919	PR 0918	PR 0916	PR 0914
BEST	**BW2134**	BR 0992	BR 0991	**BW2003**	BR 0977	M_302CA5	BR 0990	BR 1019	BR 0992	BR 1019	M_3032C0
MATE	BR 1021	**BW1155**	BR 0999	BR 0975	BR 0992	BR 1019	BR 1021	BR 0978	BR 0984	M_302CA5	BR 0995
	M_302CA5	BR 0998	BR 0996	BR 0999	BR 0983	BR 0995	BR 1019	**BW2133**	M_3032C0	BR 0983	BR 1019
	BR 0988	BR 0996	BR 1018	BR 0995	BR 0994	BR 0991	BR 0983	M_302CA5	BR 1021	BR 1021	**BW1159**
	BR 0998	M_3032C0	**BW2003**	BR 0991	BR 1020	**BW2134**	BR 0991	BR 0990	BR 0990	BR 0995	**BW1155**
	BR 0992	BR 0983	**BW1119**	**BW2134**	BR 0981	M_2FA1E0	**BW1119**	M_829DF1	BR 1020	**BW1119**	BR 0983
	BR 0984	BR 0919	BR 0987	BR 0994	**BW2133**	BR 0983	M_302CA5	BR 0977	BR 0997	**BW2133**	BR 0981
	BW1155	BR 0995	BR 0978	BR 0990	BR 0984	**BW1119**	**BW2132**	BR 1018	BR 0919	BR 0990	BR 0996
M	BR 0985	BR 1019	BR 0975	**BW1119**	M_3032C0	BR 0988	**BW2133**	BR 0984	**BW1155**	**BW1155**	BR 1021
A	**BW1159**	**BW2133**	M_2FA1E0	BR 0985	BR 1018	BR 0919	BR 0995	BR 0988	BR 0991	BR 0992	BR 0992
L	**BW2133**	M_829DF1	BR 1019	BR 0983	BR 1019	BR 0999	BR 0975	BR 0999	BR 0998	BR 1018	BR 0998
E	BR 0919	**BW2134**	BR 0997	BR 0996	BR 0995	BR 0975	**BW1155**	BR 0987	**BW2132**	**BW2132**	**BW2134**
S	BR 0995	BR 0987	BR 0993	BR 0992	BR 0996	BR 0981	BR 0984	BR 0993	BR 0995	BR 0997	BR 1020
	BR 0975	BR 0975	M_302CA5	BR 0978	BR 0990	M_829DF1	**BW2003**	**BW2003**	BR 0975	M_829DF1	**BW2003**
	BR 0993	BR 0978	BR 0981	BR 0997	M_302CA5	BR 0998	M_829DF1	**BW1119**	BR 0996	BR 0978	BR 0997
	BW2132	BR 1021	BR 0988	M_3032C0	BR 0985	**BW1159**	BR 0994	**BW2134**	BR 0977	BR 1020	**BW2133**
	BR 1019	M_302CA5	M_829DF1	BR 0988	BR 0993	BR 0987	**BW1159**	BR 0991	BR 0978	M_3032C0	BR 0999
	BR 0981	BR 0984	BR 0995	BR 0993	M_829DF1	**BW2003**	BR 0998	BR 0997	**BW2003**	BR 0998	BR 1018
	BR 0990	BR 0990	M_3032C0	**BW1159**	BR 0997	BR 0984	M_2FA1E0	BR 0983	BR 0993	BR 0984	BR 0977
	BR 0997	**BW2132**	BR 0919	BR 0987	**BW2003**	BR 0994	BR 0992	BR 0985	BR 0985	**BW1159**	M_302CA5
	BR 0994	**BW1159**	BR 0994	M_2FA1E0	**BW2134**	BR 1021	BR 0987	BR 0992	BR 0988	BR 0999	BR 0975
	M_3032C0	**BW1119**	BR 0985	BR 0984	**BW1159**	BR 1020	BR 0981	**BW1159**	**BW2133**	**BW2134**	BR 0990
	BW1119	BR 1020	**BW1159**	**BW2133**	**BW1155**	M_3032C0	BR 1020	BR 0975	**BW1159**	BR 0977	BR 0987
	BR 0978	BR 0981	BR 1020	BR 1021	BR 0999	BR 0990	M_3032C0	BR 0994	**BW1119**	BR 0987	**BW1119**
	BR 0991	BR 0997	BR 0983	BR 0981	BR 0975	**BW2133**	BR 0997	M_2FA1E0	BR 0994	BR 0991	BR 0985
	BR 0999	BR 0991	BR 0977	**BW2132**	BR 0998	**BW2132**	BR 0988	BR 0995	BR 0999	BR 0985	BR 0994
	M_829DF1	**BW2003**	**BW1155**	BR 0977	BR 1021	BR 1018	BR 0999	BR 1021	M_2FA1E0	BR 0981	M_829DF1
	BR 1020	BR 0993	BR 0990	BR 1019	**BW1119**	BR 0992	**BW2134**	**BW2132**	BR 1018	BR 0996	BR 0919
	BR 0987	BR 0994	**BW2133**	M_829DF1	BR 0988	BR 0977	BR 0919	**BW1155**	**BW2134**	BR 0994	BR 0984
	BR 1018	BR 0999	**BW2132**	**BW1155**	BR 0919	BR 0996	BR 0978	BR 0996	BR 0983	BR 0975	BR 0991
	BW2003	BR 0985	BR 0984	BR 1020	BR 0987	**BW1155**	BR 1018	BR 0981	BR 0987	**BW2003**	BR 0993
	M_2FA1E0	M_2FA1E0	**BW2134**	BR 0919	BR 0978	BR 0997	BR 0977	BR 1020	BR 0981	BR 0993	BR 0988
	BR 0977	BR 1018	BR 0998	BR 0998	**BW2132**	BR 0978	BR 0985	M_3032C0	M_829DF1	M_2FA1E0	BR 0978
WORST	BR 0996	BR 0988	BR 1021	M_302CA5	M_2FA1E0	BR 0985	BR 0996	BR 0919	M_302CA5	BR 0919	**BW2132**
MATE	BR 0983	BR 0977	BR 0992	BR 1018	BR 0991	*BR 0993*	BR 0993	*BR 0998*	BR 1019	*BR 0988*	*M_2FA1E0*

MATRIX CONTINUED

	F E M A L E S									
	PR 0913	PR 0911	PR 0910	PR 0909	PR 0907	PR 0906	PR 0905	PR 0902	PR 0901	PR 0900	PB 0915
BEST	**BW2003**	**BW2134**	BR 0987	**BW2003**	BR 1019	BR 0995	**BW2132**	BR 0992	BR 0977	BR 0991	BR 1020
MATE	M_3032C0	BR 0987	BR 1018	M_2FA1E0	BR 0995	BR 1019	**BW2133**	BR 0984	BR 0996	BR 1018	BR 0996
	BR 0984	M_302CA5	M_2FA1E0	BR 0996	BR 1021	BR 1021	M_829DF1	BR 1021	BR 0983	**BW2003**	BR 1019
	BR 0996	BR 0988	M_302CA5	BR 1018	M_302CA5	**BW2133**	M_302CA5	**BW1155**	BR 0984	BR 0987	BR 0992
	BR 0981	BR 0994	**BW2003**	BR 0993	BR 0990	M_302CA5	**BW1159**	BR 0990	**BW2003**	BR 0999	BR 0998
	BR 0994	BR 0975	BR 0993	BR 0975	**BW2133**	M_829DF1	**BW1155**	M_3032C0	M_3032C0	BR 1019	BR 0975
	BR 0990	BR 1019	BR 0975	M_3032C0	**BW2134**	**BW1159**	BR 0977	**BW1159**	BR 0992	**BW1119**	BR 1021
	BR 1020	M_829DF1	BR 0991	BR 0977	BR 0983	BR 0988	BR 1019	BR 0995	BR 0995	BR 0975	BR 0995
M	BR 0993	**BW2133**	BR 0995	BR 0991	BR 0988	**BW2134**	BR 0978	BR 0983	BR 0994	BR 0978	**BW1155**
A	BR 0975	BR 0999	BR 0983	BR 1019	M_829DF1	BR 0990	BR 1018	BR 1020	BR 0975	BR 0983	BR 0983
L	BR 0977	**BW1119**	BR 0988	BR 0988	BR 0984	BR 0984	BR 1021	**BW2134**	BR 1020	BR 0996	M_3032C0
E	BR 0988	BR 0995	BR 0999	BR 1020	**BW1155**	**BW1155**	BR 0998	BR 0977	BR 1018	M_2FA1E0	**BW2134**
S	M_2FA1E0	BR 0993	M_3032C0	M_302CA5	**BW2132**	BR 0983	BR 0995	**BW2132**	**BW1159**	**BW1159**	BR 0984
	BR 0998	BR 0983	BR 0977	M_829DF1	BR 0999	**BW2132**	**BW2134**	BR 0988	BR 0985	BR 0919	BR 0997
	BR 0995	BR 0991	**BW2134**	**BW1159**	**BW1159**	BR 0998	BR 0992	BR 0978	**BW2133**	BR 0981	**BW1159**
	BR 0985	**BW1155**	BR 0919	BR 0990	**BW1119**	**BW1119**	BR 0981	**BW2003**	BR 0990	M_3032C0	M_302CA5
	BR 0919	M_2FA1E0	BR 0990	BR 1021	M_3032C0	BR 0977	BR 0997	BR 0999	BR 0993	BR 0997	BR 0919
	BR 0987	BR 0981	BR 1019	BR 0987	BR 0981	M_3032C0	BR 0987	BR 1018	**BW2134**	**BW2134**	BR 0994
	BW1159	BR 0997	BR 0996	**BW2134**	BR 0998	BR 0994	BR 0983	**BW1119**	BR 0997	M_302CA5	M_829DF1
	BR 1021	BR 0919	BR 0978	BR 0994	BR 0991	BR 0999	M_3032C0	BR 1019	BR 0999	BR 0994	**BW2133**
	BR 0999	BR 0985	M_829DF1	BR 0995	BR 0978	BR 0981	BR 0990	BR 0997	BR 1021	BR 0993	BR 0977
	M_302CA5	BR 0978	**BW2132**	**BW2132**	BR 1020	BR 0985	BR 0993	**BW2133**	BR 0987	BR 0992	BR 1018
	BR 0992	BR 0998	**BW1119**	**BW1119**	**BW2003**	BR 0992	**BW1119**	BR 0975	**BW1155**	BR 1020	BR 0990
	BW2134	**BW2003**	BR 0997	BR 0984	BR 0997	**BW2003**	BR 0984	BR 0991	BR 0988	BR 0990	BR 0978
	BR 0997	BR 1021	BR 0994	BR 0985	BR 0992	BR 1018	M_2FA1E0	M_2FA1E0	**BW1119**	M_829DF1	**BW2003**
	BR 0991	BR 0996	**BW2133**	BR 0998	BR 0977	BR 0978	BR 1020	BR 0996	BR 0919	**BW2132**	BR 0987
	BR 1019	BR 0992	**BW1155**	BR 0997	BR 0985	BR 0987	BR 0985	BR 0985	BR 0998	BR 0985	BR 0981
	BW1119	BR 0990	**BW1159**	**BW2133**	BR 0993	BR 1020	BR 0988	BR 0993	M_302CA5	BR 0977	BR 0985
	BW2132	BR 1018	BR 0985	BR 0978	BR 1018	BR 0991	BR 0994	M_829DF1	BR 0991	BR 0988	**BW2132**
	BR 1018	M_3032C0	BR 0981	BR 0983	BR 0975	BR 0975	BR 0919	BR 0994	BR 0981	BR 0984	BR 0993
	BR 0983	**BW2132**	BR 1020	BR 0999	BR 0919	BR 0997	**BW2003**	BR 0998	BR 1019	BR 0995	**BW1119**
	M_829DF1	BR 0977	BR 0998	**BW1155**	BR 0987	M_2FA1E0	BR 0991	BR 0981	**BW2132**	**BW2133**	BR 0991
	BW2133	**BW1159**	BR 0992	BR 0919	M_2FA1E0	BR 0993	BR 0999	BR 0919	M_2FA1E0	**BW1155**	BR 0988
WORST	**BW1155**	BR 0984	BR 0984	BR 0981	BR 0994	BR 0996	BR 0996	BR 0987	BR 0978	BR 0998	M_2FA1E0
MATE	BR 0978	*BR 1020*	*BR 1021*	BR 0992	BR 0996	BR 0919	*BR 0975*	M_302CA5	M_829DF1	*BR 1021*	BR 0999

RECENT TECHNICAL MEMORANDUMS

SWFSC Technical Memorandums are accessible online at the SWFSC web site (http://swfsc.noaa.gov). Copies are also available form the National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22161 (http://www.ntis.gov). Recent issues of NOAA Technical Memorandums from the NMFS Southwest Fisheries Science Center are listed below:

NOAA-TM-NMFS-SWFSC-426 Fish and invertebrate bycatch estimates for the California drift gillnet fishery targeting swordfish and thresher shark, 1990-2006.
J.P. LARESE and A.L. COAN, JR.
(July 2008)

427 AMLR 2007/2008 field season report: Objectives, Accomplishments, and Tentative Conclusions.
A.M. VAN CISE, Editor
(October 2008)

428 Killer whales of the ETP: A catalog of photo-identified individuals
P. OLSON and T. GERRODETTE
(November 2008)

429 Acoustic studies of Marine Mammals during seven years of combined visual and acoustic line-transect surveys for cetaceans in the eastern and central Pacific Ocean.
S. RANKIN, J. BARLOW, J. OSWALD, and L. BALLANCE
(November 2008)

430 Spawning biomass of Pacific sardine *(Sardinops sagax)* off U.S. in 2008.
N.C.H. LO, B.J. MACEWICZ, D.A. GRIFFITH, and R.L. CHARTER
(November 2008)

431 Reliability of California's groundfish landing estimates from 1969-2006.
D.E. PEARSON, B. ERWIN, and M. KEY
(November 2008)

432 Framework for assessing viability of threatened Coho salmon in the southern Oregon/Northern California coast evolutionarily significant unit.
T.H. WILLIAMS, B.C. SPENCE, W. DUFFY, D. HILLEMEIER, G. KAUTSKY, T. LISLE, M. McAIN, T. NICKELSON, E. MORA, and T. PEARSON
(December 2008)

433 Stenella abundance research line transect and ecosystem (STAR-LITE) 2007 cruise report.
F.I. ARCHER, A.E. HENRY, and L.T. BALLANCE
(December 2008)

434 U.S. Pacific marine mammal stock assessments: 2008
J.V. CARRETTA, K.A. FORNEY, M.S. LOWRY, J. BARLOW, J. BAKER, D. JOHNSTON, B. HANSON, M.M. MUTO, D. LYNCH, and L. CARSWELL
(January 2009)

435 Preliminary estimates of harbor porpoise abundance in California waters from 2002 to 2007.
J.V. CARRETTA, K.A. FORNEY, and S.R. BENSON
(February 2009)