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PROJECT 4: HATCHERY TROUT EVALUATIONS

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Project 4: Hatchery Trout Evaluations

Subproject #1: Improving Returns of Hatchery Catchable Rainbow Trout Including Evaluations of Statewide Exploitation Rates, Hatchery Rearing Density, Hatchery Size Grading, and Magnum Versus Standard Catchable Releases

Subproject #2: Relative Performance of Triploid Kokanee Salmon in Idaho Lakes and Reservoirs

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ABSTRACT

Idaho Department of Fish and Game (IDFG) hatcheries are integral to managing coldwater sportfishing opportunities in Idaho. Current hatchery production capacity and funding are not increasing, while demand for hatchery catchable-sized trout (i.e., ~250 mm in length) remains steady or is increasing. A comprehensive evaluation of hatchery catchable trout exploitation rates (i.e., return-to-creel) and total catch rates (i.e., harvested fish plus released fish) in Idaho's predominant put-and-take fisheries has been lacking. This project is intended to (1) evaluate exploitation and catch rates of the most-stocked water bodies statewide, and (2) conduct research experiments focusing on hatchery rearing techniques to increase return-to-creel of catchable Rainbow Trout *Oncorhynchus mykiss*. In 2011 and 2012, IDFG released nearly 68,000 non-reward tagged hatchery Rainbow Trout across more than 60 water bodies, including lakes, reservoirs, community ponds, and rivers. A portion of these releases were intended to evaluate return-to-creel rates of fish reared at high (0.3 lbs/ft^3/inch), medium (0.23 lbs/ft^3/inch), and low (0.15 lbs/ft^3/inch) raceway densities. The statewide average total length (± 95% confidence intervals) of tagged catchable Rainbow Trout released in 2012 was 254 ± 0.3 mm. Average harvest and total catch for catchable Rainbow Trout across all evaluated waters was 20.0% (± 3.1%) and 25.9% (± 4.0%) respectively, for all tags released in 2012 and reported within 365 days of release. On average, harvest and total catch for 15 community ponds was 41.9% (± 6.9%) and 53.6% (± 8.7%), respectively. Mean total catch of Rainbow Trout remained significantly different across in-hatchery rearing densities for both the second year post-release of 2011 tags and for the first year post-release of 2012 tags. The low density treatment had the highest total catch on average, and was significantly different from medium- and high-density groups. However, the higher return-to-creel of fish raised at low densities is not sufficient to offset the reduced number of fish raised and stocked. Additionally, we evaluated returns-to-creel based on strain, release season, length, and length-rank at release. Clearsprings diploid catchables had higher total catch rates than Hayspur diploids, while triploid groups from Troutlodge and Hayspur were not significantly different. For all water body types combined, summer and fall release groups had the highest catch rates, followed by spring. Return-to-creel increased with increasing fish length, and from 200 mm to 305 mm there was roughly a 5% increase in catch rates for each 25 mm increase in length at stocking. Individual fish's length-rank within a release group showed a mixed correlation to catch from 2011 to 2012. Future work should further evaluate length and length-rank in relation to catch rates, and explore rearing options that result in maximizing the size-at-release vs. rearing cost relationship as well as reduced size variation.

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INTRODUCTION

Idaho Department of Fish and Game (IDFG) hatcheries are integral to managing coldwater sportfishing opportunities in Idaho. IDFG's "resident" (non-anadromous) hatchery program consists of 10 hatcheries that raise up to 18 species and strains of salmonids for inland coldwater fisheries. In 2009, Idaho resident hatcheries stocked over 17.6 million fish in over 500 waters (Frew 2010), including about 2.2 million "catchable" Rainbow Trout *Oncorhynchus mykiss*. Producing catchable Rainbow Trout (typically stocked at an average size of 250 mm – 305 mm in length) accounts for over 50% of the annual Resident Hatchery budget and about 84% of the total weight of fish stocked annually. Hagerman, Nampa, and American Falls hatcheries provide the majority of IDFG catchable trout, with Hagerman providing almost half. According to the default catchables stocking request list, catchable Rainbow Trout are planted in 293 waters throughout Idaho. Despite the large number of waters stocked with catchable Rainbow Trout, a small number of them account for most of the total catchable Rainbow Trout stocked. For example, five waters (Cascade, American Falls, Blackfoot, Chesterfield reservoirs, and Lake Walcott) account for 14% of the total annual catchable production, and 30 waters account for 50% of total production

Current hatchery production capacity and funding are not increasing, while demand for hatchery catchable trout remains steady or is increasing. Considering the costs associated with stocking catchable trout, a comprehensive evaluation of hatchery catchable exploitation rates (i.e. return-to-creel) in Idaho's predominant put-and-take fisheries is needed. Total hatchery production is an insufficient measure to determine whether hatcheries are successful. Instead, hatchery success should be measured in terms of contribution to harvest (Blankenship and Daniels 2004). Recent IDFG studies have begun to evaluate return-to-creel on a statewide basis using angler-caught tagged fish (Meyer et al. 2010). These evaluations were mainly intended to evaluate regional fisheries management objectives and establish typical exploitation rates for warm-water and cold-water fisheries. Meyer et al. (2010) estimated exploitation rates for hatchery catchable Rainbow Trout in four of the top-10 waters stocked but only six of the top-20 waters. While this represents a step in the right direction, only a handful of water bodies have been evaluated over several years (Table 1), so little is known about variation in return-to-creel rates between years in our major stocked fisheries. Given the current economic climate for IDFG hatchery funding, efforts must be made to ensure that hatchery programs remain efficient while producing a quality product for Idaho anglers.

One of the key metrics defining a "quality" hatchery trout should be measured in terms of contribution to angler return-to-creel (either catch or harvest). More information on return-to-creel rates of catchable Rainbow Trout is currently needed. Exploitation rates of Idaho's most prominent stocked fisheries could identify locations were catch objectives are met or where stocking is not providing the intended benefit. This information could identify underperforming fisheries or poor fish performance. Decisions about effective allocation of catchable trout could subsequently improve the efficiency of the resident hatchery system and directly benefit anglers by increasing return-to-creel of catchable trout. This type of monitoring and evaluation program will be critical to guide the decision-making process and implement changes in allocating catchable Rainbow Trout production.

In addition to the primary goal of determining exploitation rates for major catchable trout fisheries, evaluating methods to increase return-to-creel is also important. Rearing conditions and culture techniques vary across hatcheries and can affect post-stocking survival and return-to-creel. Differences in rearing conditions such as raceway density (Elrod et al. 1989) or feed type (Barnes et al. 2009) can affect the quality and return-to-creel of hatchery fish. The effect of rearing density on postrelease survival of hatchery salmonids has been widely studied for Chinook Salmon *O. tshawytscha* (Martin and Wertheimer 1989), Coho Salmon *O. kisutch* (Fagerlund et al. 1981; Schreck et al. 1985; Banks 1992) and Steelhead Trout (Tipping et al. 2004). Results are often inconsistent and difficult to interpret and may differ between species, brood years, and hatcheries (reviewed in Ewing and Ewing 1995). While rearing density effects on postrelease survival have been studied for anadromous Pacific salmonids, few studies are available for inland trout species. Previous studies have mainly focused on in-hatchery performance of Cutthroat Trout *O. clarkii* (Kindschi and Koby 1994, Wagner et al. 1997), Lake Trout *Salvelinus namaycush* (Soderberg and Krise 1986), and Rainbow Trout (Kindschi et al. 1991; Wagner et al. 1996; Procarione et al. 1999). These studies generally concluded that rearing fish at high densities often results in lower survival, decreased growth, decreased food conversion rates, and reduced health.

Managing basic resources such as rearing space, water flows, and rearing densities are highly important to hatchery operations (Banks and LaMotte 2002). Optimizing rearing density is one technique that may help enhance recruitment of hatchery-reared fish from stocked fisheries (Elrod et al. 1989). Lower rearing densities may increase the yield of stocked fish, or provide an economic benefit to hatcheries if losses from disease outbreaks are reduced. Rearing fish at lower densities means that fewer total fish will be produced, and return rates from low-density groups must be high enough to compensate for the reduced numbers of trout stocked (Martin and Wertheimer 1989).

In addition to optimizing rearing densities, other rearing factors such as size-at-release may influence return-to-creel rates. The current target length for a catchable trout released from an IDFG hatchery is 10 inches (254 mm). Previous studies have shown a strong correlation between increased size-at-release and increased return-to-creel for hatchery trout (Mullan 1956; Wiley et al. 1993; Yule et al. 2000). While larger trout may return to the creel at a higher rate, it is also important to note that rearing fish to a larger size comes with significant increases in rearing costs and it is important to find a balance between size-at-release, rearing costs, and return-to-creel. Additional rearing tools such as size grading can be used as a means to select for larger fish from a given rearing container at the time of release. By selecting the larger fish for release, smaller fish can be retained and given additional rearing time to increase their size. Size grading has been shown to have varying benefits in hatchery rearing. Grading was shown to be an effective tool to decrease variance and increase overall size of hatchery Yellow Perch *Perca flavescens* (Wallat et al. 2005) and increase growth in hatchery Atlantic Salmon *Salmo salar* (Gunnes 1976). However, grading was shown to have no growth benefit in Arctic Charr *Salvelinus alpinus* (Wallace and Kolbeinshavn 1988) and was concluded to not be recommended as a standard rearing procedure to increase weight gain in rearing Brook *Salvelinus fontinalis*, Brown *Salmo trutta*, and Rainbow Trout (Pyle 1966).

As operating costs continue to increase, rearing fish more efficiently will become more important. Encouraging innovation and experimentation in hatcheries will help these facilities respond to new goals and culture techniques (Blankenship and Daniels 2004). Evaluating how rearing techniques affect return-to-creel could aid in developing strategies to raise fish more effectively. Additionally, continued monitoring of return-to-creel rates associated with variables such as strain and ploidy of hatchery-reared Rainbow Trout, season-of-release, and size-at-release are convenient evaluations that are by-products of large scale exploitation and paired hatchery rearing evaluations.

Study Questions

This project will consist of two major components: (1) a statewide evaluation of exploitation rates of the most-stocked water bodies, and (2) research experiments focusing on hatchery rearing techniques to increase return-to-creel of catchable trout. The following is an outline of the primary and secondary goals related to these two components:

Primary Goal (Exploitation Rates): Allocate hatchery resources to maximize benefit to anglers from hatchery Rainbow Trout stocked in Idaho waters.

Objectives:

- Determine the average return-to-creel (exploitation) rates of catchable Rainbow Trout in *at least* the top 50% of waters stocked (as determined by the total trout stocked).
- Describe the variation in exploitation rates across several years within these waters.

Secondary Goal (Hatchery Rearing Techniques): Increase hatchery production efficiency by modifying rearing practices to maximize return-to-creel rates.

Objectives:

- Evaluate return-to-creel rates of Rainbow Trout raised at different densities at major IDFG production facilities.
- Compare return-to-creel rates of Rainbow Trout raised at different hatcheries at similar densities and stocked at the same locations.
  - Do return-to-creel rates differ when raised under different rearing densities within the same hatchery?
  - Do return-to-creel rates differ between hatcheries for fish raised under similar densities?
- Compare return-to-creel rates of different strains of Rainbow Trout at Hagerman Hatchery.
- Evaluate return-to-creel rates of Rainbow Trout that are graded prior to release vs. non-graded controls.
- Evaluate return-to-creel benefit from releasing *magnum*-sized catchables (average 325 mm) vs. traditional-sized catchables (average 250 mm).

Previous research has indicated tag returns can be highly variable across reservoirs and streams and across years, but current data for Idaho's major catchable fisheries is limited. Dillon et al. (2000) reported unadjusted tag return rates for catchable Rainbow Trout in 18 Idaho streams ranged from 7.5 - 42.5%, averaging 17.1%. Megargle and Teuscher (2001) estimated return rates of catchable Rainbow Trout in 16 Idaho waters between Hagerman, Nampa, and American Falls hatcheries in 1999 and 2000. Return rates were highly variable among locations, (15 - 73%), and showed significant year-to-year variation in return rates within stocking locations and hatcheries. Using high-dollar reward tags to establish reporting rates, Meyer et al. (2012) found reporting rates for hatchery Rainbow Trout (across multiple water bodies) ranged from 41.0% - 56.8% across three years. Given the inherent variation in tag returns between locations and years, this program should proceed for at least five years, and possibly more. Several years of data may be needed to encompass random yearly variation in exploitation rates of the most-stocked fisheries.

METHODS

Study Sites

Study sites were selected based on data in the 2010, 2011, and 2012 IDFG Default Catchables Request List. Waters were ranked according to total number of catchable Rainbow Trout planted annually and chosen to evaluate locations that comprise at least 50% of the total catchable Rainbow Trout stocked annually. Many study sites played a dual role in evaluating exploitation rates, as well as being used for one or more of the experiments on rearing density treatments, size grading, comparisons between hatcheries, strain evaluations, comparisons between seasons of release, and comparisons of length and length-rank at release. Additional waters were added, as resources allowed, to evaluate to the level of 60% of waters stocked and to add additional waters to increase sample sizes for rearing density and size grading comparisons. Exploitation was evaluated as both “total caught” (any fish kept or released) and “harvested” (only fish that were kept).

When taken individually, community ponds do not receive enough fish to be considered in the “Top-50%,” but they account for the most catchable Rainbow Trout stocked annually when combined (about 10% of the total release). Therefore, a statewide assessment of return-to-creel across community ponds was deemed necessary. Regional Fishery Managers from each region supplied a list of small ponds with general harvest regulations managed as short-term put-and-take fisheries, often located in or near populated areas. This list was stratified into low/medium/high groups based on perceived harvest, and tags were distributed to include a subsample of ponds in most regions on a three-year rotation (Table 2).

Rearing Density Study

In 2011 and 2012, fish were tagged and released as part of the rearing density study. Rainbow Trout for the rearing density experiments originated as eggs purchased from Troutlodge Inc., an all-female triploid Rainbow Trout stock commonly used in IDFG facilities. Density trials were conducted at the three IDFG facilities that produce the most catchable trout statewide: Hagerman, Nampa, and American Falls fish hatcheries. Most IDFG facilities set a target maximum raceway density index (DI) value of 0.3 lbs/ft^3/inch of fish, based on the recommendations of Piper et al. (1982) and past experience. Rearing density treatment values were assigned low/medium/high as 50%, 75%, and 100% of the target maximum density index value. Therefore, the raceway rearing density index values for the low/medium/high treatments were 0.15, 0.23, and 0.30, respectively. Because of space limitations in 2011, there were only two treatment groups, low (0.15) and high (0.30), at Hagerman Fish Hatchery. All three treatment groups were administered at Nampa and American Falls fish hatcheries in 2011 and all three facilities in 2012. Rearing density groups were not to exceed the specified maximum treatment density index for each treatment during the rearing period. As fish grew and densities increased, fish were extended into lower raceway sections to avoid exceeding the specified maximum values. Treatment densities were assigned to individual egg lots and carried through one entire raceway, so that only a single treatment was raised in each raceway. The approximate number of fish for each treatment raceway was first established using egg counts. Treatment lots were then inventoried at the fry stage using pound-counts when transferred from hatching containers to outside raceways, and when moved between raceways.

Rearing density treatment groups were raised using culture techniques standard to each facility. Raceway densities and fish sizes were monitored closely to minimize size differences between treatment groups and hatcheries. Feeding rates were adjusted using monthly pound counts and feed projections to adjust growth to a target size of 3 fish/lb at 10 inches at stocking. Feed projections at each hatchery were done using the Hatchery Constant (HC) method (Piper et al. 1982) with $\Delta L = 0.025–0.033$ to target 1 inch of growth per month. Projections were adjusted to reflect changes in loading rates from mortalities and stocking events. All facilities fed treatment groups a floating commercial trout diet (Rangen Inc. EXTR 450). Feed size was adjusted for fish length based on feed guidelines provided by Rangen Inc.

Each hatchery's rearing environment for the density study is outlined below. In addition to evaluating rearing densities, the study design and repetition at Nampa, American Falls, and Hagerman fish hatcheries allowed us to compare returns between these three hatcheries.

American Falls Fish Hatchery

Rainbow Trout were reared on 12.8°C spring water in single-pass fashion. Fry were started in concrete vats (17.5' x 4' x 2.5') and fed using a combination of hand-feeding and belt-feeders. After reaching approximately 200 fish/lb, fish were inventoried using pound counts and moved to outdoor concrete raceways (8' x 200' x 2' sections). Fish were reared in these raceways and hand-fed for the remainder of the rearing period.

Hagerman Fish Hatchery

Density treatment groups were reared on the Tucker Spring water source (15°C). Fry were started in indoor concrete vats (14' x 2.7' x 2'). After reaching 1.80 inches, fish were inventoried using pound counts and moved to small outdoor concrete raceways (100' x 3.6' x 1.8'). After reaching 3 inches, fish were again inventoried and moved to large concrete raceways (8' x 100' x 2' sections). Upon reaching 8 inches, fish were again inventoried and moved to large concrete raceways (12' x 100' x 2' sections), where they were raised for the remainder of the rearing period. Fish were fed by hand until reaching 4 inches in the large raceways, at which time they were fed mechanically with a tractor-towed feed blower.

Nampa Fish Hatchery

Nampa Fish Hatchery raised fish on single-pass water from a spring source at 15°C. Density treatment groups were hatched into small concrete outdoor raceways (5' x 25'' x 2' sections) and fed using a combination of hand-feeding and belt feeders on a 12-hour timer. After reaching 50-75 fish/lb, fish were inventoried using pound counts and moved to large outdoor concrete raceways (12' x 100' x 2' sections) and hand fed for the remainder of the rearing period.

Strain Evaluation

The Idaho Department of Fish and Game has its own hatchery Rainbow Trout broodstock known as the Hayspur Strain. Historically, the Hayspur broodstock has not been able to produce a sufficient number of eggs that would be available at the right time to produce all catchables statewide. To compensate, many of the catchable Rainbow Trout raised in IDFG facilities are purchased as all-female eggs from Troutlodge, Inc. (Sumner, Washington). Previous work by Koenig et al. (2011) showed that the all-female Troutlodge strain had higher survival rates than the mixed-sex Hayspur strain in high mountain lakes in Idaho. These findings further skewed egg requests towards the Troutlodge strain, yet a similar comparison in lowland lakes and reservoirs has not been conducted. For our comparison we used an all-female

Troutlodge strain, mixed-sex Hayspur strain, and a mix-sexed strain from Clear Springs Food, Inc. Diploid [2N] and triploid [3N] varieties of all three strains were used.

In 2011, five water bodies were used to evaluate two different strains (Hayspur 2N and Clear Springs 3N) of hatchery Rainbow Trout. All fish were reared at Hagerman Fish Hatchery under similar rearing conditions, and release groups for each strain were of similar size. All releases occurred in the fall between early October and early November.

In 2012, five different stains (Hayspur 2N and 3N, Clear Springs 2N and 3N, and Troutlodge 3N) were evaluated. Various strains were compared across six different water bodies. Similar to 2011, in 2012 all fish were reared at Hagerman Fish Hatchery, but releases occurred across the spring and fall.

Size Grading

A prerelease size grading evaluation was started at three IDFG resident trout hatcheries in 2013. Similar to the density study, American Falls, Hagerman, and Nampa fish hatcheries are being used for the grading study. The study is designed as a paired study at each facility and all tagged, graded fish that are stocked have a group of traditionally-reared, non-graded, tagged catchable trout (Troutlodge, all-female) stocked into the same water body at the same time. Graded treatment raceways and non-graded control raceways are reared on similar water sources at similar flow and densities. At each facility, a group of fish was graded in the spring (April–June) and a group was graded in the summer/fall (July/August–September/October). Each grade group had an initial grading event where fish that were 10 inches or greater were targeted to be graded off and stocked out. Remaining fish were reared for a four-week period and then a second grading event occurred and fish were stocked again. Remaining fish were reared an additional four weeks and stocked out. At each grading event and at final stocking, up to three release locations received graded and non-graded tagged fish that represented up to 10% of the total release at each release location during that time interval. Each hatchery's rearing and grading strategy is outlined below.

American Falls Fish Hatchery

At American Falls, there was one treatment (graded) and one control (non-graded) raceway in the spring and one treatment and one control raceway in the fall. The spring treatment group received their first grade/stocking in early April, their second grade/stocking in early May, and the remaining fish were stocked in early June. The fall group received their first grade/stocking in September, their second grade/stocking in October, and the remaining fish were stocked in November. Fish were graded using passive grading crowder racks crowded from the upper and lower end of the treatment raceways.

Hagerman Fish Hatchery

At Hagerman, there were two treatment and two control raceways in the spring (one 2N and one 3N) and one treatment and one control raceway in the summer/fall. One spring treatment group received their first grade/stocking in early April, their second grade/stocking in early May, and the remaining fish were stocked in early June. The other spring treatment group received their first grade/stocking in late April, their second grade/stocking in late May, and the remaining fish were stocked in late June. The summer/fall group received their first grade/stocking in July, their second grade/stocking in September, and the remaining fish were stocked in October. Initially, both passive grading crowder racks and active pumping of fish across a grading rack fixed to a sorting tower were used, but the staff determined using passive racks crowded from the top and bottom of the raceway was the most efficient grading method.

Nampa Fish Hatchery

At Nampa, there were two treatment and two control raceways in the spring and one treatment and one control raceway in the summer/fall. Both spring treatment groups received their first grade/stocking in mid-April, their second grade/stocking in mid-May, and the remaining fish were stocked in mid-June. The summer/fall group received their first grade/stocking in July, their second grade/stocking in August, and the remaining fish were stocked in September. Initial groups (spring) were graded by pumping fish across a grading rack fixed to a tower. For fall grading, both passive crowd-racks and active pump grading were used.

Magnums

In addition to evaluating size grading, in 2013 we wanted to evaluate an overall larger sized catchable compared to the traditional 250 mm catchable Rainbow Trout. To do this, we reared a group of catchables at American Falls Fish Hatchery that averaged 325 mm in total length (magnums). Paired release groups of 200 magnums and 200 traditional catchables were tagged at American Falls in June and released into 10 different water bodies across southern Idaho. Releases were in conjunction (within two weeks) with the standard releases from hatcheries that traditionally stocked the same waters, so that fishing pressure would be typical.

Tagging

Trout were crowded within raceways, then collected with dip nets to be tagged. Crowding fish helped ensured a random sample of fish from the entire raceway and helped reduce size-selected bias. Trout were individually measured for total length (mm) and tagged using 70 mm (51 mm of tubing) fluorescent orange/red T-bar anchor tags treated with algaecide and manufactured by Floy® (2011, 2013) and Hallprint® (2012). By taking lengths of all tagged fish, we were also able to evaluate effects of size-at-release on tagging returns, since fish were released within a day of tagging. Trout were returned to submerged enclosures or unoccupied raceway sections and allowed to recover overnight. Tagged trout were then loaded by dip net onto stocking trucks and transported to stocking locations. Mortalities and shed tags were collected and recorded before loading fish for transport. After stocking, truck tanks were checked for shed tags.

Site-specific exploitation rates were determined using the normal requested stock of fish whenever possible, originating from the typical facility. In these locations, fish were marked from the normal production lot raceways. Tagged fish were loaded along with the total stocking load, allowed to mix, and were stocked using standard release methods. Fish from the rearing density trial were tagged from the respective experimental raceways, and then combined and loaded with the normal lot of fish scheduled for that stocking event. For additional comparisons, some hatcheries stocked density trial fish in locations they normally do not stock. In these cases, tagged fish were transported alone, without additional production fish. For the grading study, stocking groups were split 50:50 between treatment and control raceways with representative groups of tagged fish coming from each. For the magnum component, magnum and standard catchables groups from American Falls Fish Hatchery were tagged and released independently at study waters, in conjunction with other hatchery's releases into the same waters.

Anchor tags were labeled with “IDFG” and tag reporting phone number (IDFG 1-866-258-0338) on one side, with the tag number on the reverse side. Anglers could report tags using the IDFG “Tag-You’re-It” phone system and website, as well as at regional IDFG offices and by mail.

Meyer et al. (2012) estimated average non-reward tag reporting rates for hatchery trout in Idaho at about 49.4% with year/site-specific ranges from 33.5 to 75.2%. The wide range observed suggests reporting rates at individual water bodies may continue to vary widely. Using reward tags to correct for tag return rates over time can help reduce this inaccuracy and ensure exploitation rates are accurately calculated. Reward tags were used to monitor potential declines in tag reporting rate that can occur over time if anglers lose interest or become “swamped” by too many tags (Henny and Burnham 1976). Additionally, few tags have been used in evaluating return-to-creel from community ponds, so whether the average reporting rate differed from other water types was unknown. A subset of waters was chosen to receive reward tags in addition to standard non-reward tags. In locations that received reward tags, rewards were distributed at a constant rate of 10% of the total tags planted. Reward tags were identical to non-reward tags in size, shape and color in 2011, but contained additional text (“Reward”) and the amount (“$50”). In 2012 and 2013, the original 2011 batch of reward tags was used but did not necessarily match the non-reward tags in color. Tags of $50 were used because they have shown sufficiently high reporting rates (88.4%) for catchable rainbow without the added cost of $100 or $200 tags (Meyer et al. 2012).

Many stocked waters receive several plants over the course of the fishing season. Tags were distributed to characterize average return rates over the fishing season more accurately. Many lakes and reservoirs were stocked with a large plant of trout in spring, followed by a second smaller plant in fall. We distributed tags during spring and fall stocking events to capture both stocking events. Other locations were stocked more frequently (community ponds, rivers). Typically, 400 tags (plus any reward tags at a 10% rate when used) were stocked for exploitation rates. In smaller waters, we reduced the number of tags in a given plant to no more than 10% of the total fish stocked to avoid “swamping” anglers with tags. We used a similar tagging protocol for the rearing density trial groups. We tagged 200 fish from each treatment group per stocking event. In some cases (Nampa Fish Hatchery), we had the opportunity to tag additional groups of normal production Rainbow Trout (n = 200) for added comparisons. For the grading study, tags were split 50:50 between treatment and control raceways. Large releases received up to 800 tags (400 treatment and 400 control) while smaller releases were tagged at 10% of the total release (5% treatment and 5% control).

Data Analysis

Angler tag return rate (λ) was estimated using the relative reporting rate of non-reward tags relative to that of high-reward tags (Pollock et al. 2001). The associated variance was calculated according to Henny and Burnham (1976) and used to generate 90% confidence intervals (CIs). Statewide average reporting rate for Rainbow Trout found in Meyer et al. (2012) was calculated using $100 and $200 reward tags,

$$\lambda = \frac{Rr / Rt}{Nr / Nt}$$

where R_t and R_r are the number of standard tags released and reported, respectively. N_t and N_r are the number of high-reward tags released and reported, respectively. We were concerned that tag reporting rates may have changed over time from previous studies, and that the average tag reporting rate might be different for heavily fished community ponds. We calculated tag reporting rates separately for community ponds (where rewards were used) and all other waters. Reporting rates (based on $50 tags) were then corrected to account for the fact that only about 88.4% of $50 tags are actually reported, using the data of Meyer et al. (2012). Angler tag return rate was only based on tag returns from waters where both non-reward and reward tags were stocked simultaneously (always a 10:1 ratio).

We calculated exploitation both within one year (365 days) after stocking, and in the second year (366 to 730 days) after stocking, according to the methods of Meyer et al. (2010). The annual unadjusted harvest rate (u) was calculated as the number of non-reward tagged fish reported as harvested within one year of tagging, divided by the number of non-reward tags released. Unadjusted harvest and total catch were adjusted (u') by incorporating the average angler tag reporting rate (λ), first year tag loss (Tag_l), and tagging mortality (Tag_m) for Rainbow Trout tagged as part of this study. Extensive Floy®-tagging from 2006 to 2009 presented in Meyer et al. (2010) found values for all three variables of λ = 49.4, Tag_l = 8.2%, and Tag_m = 0.8%. Estimates were calculated for each individual stocking event using the formula:

$$u' = \frac{u}{\lambda(1 - Tag_l)(1 - Tag_m)}$$

Variance for the denominator in the above equation was estimated using the approximate formula for the variance of a product in Yates (1953). Variance for u' was calculated using the approximate formula for the variance of a ratio (Yates 1953) and was used to derive 90% CIs. A more complete description of these methods and the associated formulas is presented in Meyer et al. (2010).

Because some anglers release fish voluntarily, exploitation estimates may not necessarily characterize the utilization of fish by anglers (Quinn 1996). To account for catch-and-release in addition to harvest, we also calculated “total catch.” For total catch, we changed u' to include the total fish caught for each release group, including those harvested and released. Calculations were otherwise performed as described above.

We compared tag returns across rearing densities, hatcheries, strain, seasons-of-release, and size-at-release with multiple ANOVA and Tukey’s multiple comparisons using Proc GLM with $\alpha = 0.1$ (SAS 9.2). The models included angler catch as the dependent variable. Sample size for comparisons was based on individual water bodies as the unit of observation. Initial analyses indicated second- and third-order interaction terms were not significant, so we limited our analyses to include only first-order interaction terms.

RESULTS

Statewide Exploitation

Release Year 2011

Data associated with the first year of returns from fish released in 2011 were reported in the 2013 Resident Hatchery Research Report (Cassinelli and Koenig 2013). During the second year-at-large (days 366-730), statewide harvest and total catch (± 90% C.I.) for hatchery catchable Rainbow Trout across the waters we evaluated was 2.7% (± 1.6%) and 3.2% (±

1.9%), respectively. The majority of year-2 catch occurred in lakes and reservoirs where carryover and survival of hatchery fish were highest. Catchable trout in community ponds and rivers only made up 2.5% of the fish harvested in the second year at large. Cumulative catch by day for rivers, community ponds, and lakes/reservoirs over the two years at large are shown in Figure 1. Catch and harvest of hatchery catchable Rainbow Trout released in 2011 and caught in the first and second year at large can be found in Appendix A.

Release Year 2012

In 2012, 34,490 nonreward tagged hatchery Rainbow Trout were released across 52 waters statewide and included 234 individual tag groups (Table 1). By November 8, 2013, anglers returned 3,644 of these tags (within 365 days of each individual plant). Harvest and total catch varied widely (0-100%) across all waters. Table 1 provides detailed results by IDFG Region for each water in this study, by stocking event. On average, statewide harvest and total catch (± 90% C.I.) for hatchery catchable Rainbow Trout across the waters we evaluated was 20.0% (± 3.1%) and 25.9% (± 4.0%), respectively, for all tags released in 2012 and reported within 365 days of release. During 2012, tagged Rainbow Trout were released into 15 community ponds over 41 tagging events. On average, harvest and total catch for these community ponds was 41.9% (± 6.9%) and 53.6% (± 8.7%), respectively. However, estimated harvest for individual tag groups varied widely across ponds, ranging from 15% to 100% (Table 1).

Catchable trout in community ponds and rivers were caught quickly after stocking. The mean and median days-at-large for community ponds were 21 and 8 days, respectively and for rivers, 36 and 19 days, respectively. Catchables in lakes and reservoirs had more of a delayed catch with mean and median days-at-large of 83 and 51 days, respectively (Figure 2).

The statewide average total length (± 95% C.I.) of catchable Rainbow Trout tagged during 2012 was 254 ± 0.3 mm (10.0 in) when measured across all waters and hatcheries. However, total length varied among hatcheries and was likely influenced by tagging date (later tagged fish being larger), and the rearing hatchery of origin.

Rearing Density Study

Release Year 2011

Data associated with the first year of returns from fish released in 2011 as part of the rearing density study, were reported in the 2013 Resident Hatchery Research Report (Cassinelli and Koenig 2013). With the addition of the second year-at-large, mean total catch of Rainbow Trout remained significantly different across rearing densities (P <0.0001, F = 12.92, df = 2). The low density treatment had the highest total catch (28.1%) on average, and remained significantly different from medium-density (24.1%) and high-density groups (22.4%). Mean total catch for the medium- and high-density groups were not statistically distinguishable. Water body remained a significant factor (P <0.0001, F = 68.26, df = 22) in the model, indicating much of the variation in total catch was due to inherent differences among waters. The model included a significant interaction between water and rearing hatchery, indicating that the return rate by hatchery was influenced by the waters each hatchery stocked.

Release Year 2012

Similar to 2010/2011, rearing density index values fluctuated over time during the rearing period as fish grew and as rearing space was adjusted in 2011/2012. Raceway volume was adjusted over time to prevent treatment groups from exceeding treatment densities. On average, treatment densities were below the specified maximum density values of 0.15, 0.23, and 0.30 for the low/medium/high-density treatments (Table 3). Similar to the first year of the study, densities at American Falls and Hagerman fish hatcheries were consistently below specified treatment values (Figure 3, Figure 4), while density index values at Nampa Fish Hatchery were the closest to the specified treatments (Figure 5). Rainbow Trout included in the density rearing experiment ranged in average size from 227 mm to 280 mm at the time of stocking, with slight differences in average length between density treatment groups. At Hagerman and American Falls fish hatcheries, low-density fish were slightly longer than both medium- and high-density fish, while at Nampa Fish Hatchery medium density fish were the longest (Table 3).

Mean total catch of Rainbow Trout was significantly different across rearing densities ($P = 0.0008$, F = 7.169, df = 2). The low density treatment had the highest total catch (29.9%) on average, and was not significantly different from medium-density (29.3%), but was significantly higher than the high-density groups (22.6%) (Figure 6). Water body was a significant factor ($P < 0.0001$, F = 17.15, df = 19) in the model, indicating much of the variation in total catch was due to inherent differences among water bodies (Figure 7). Additionally, mean average length of fish released at different densities were significantly different across all three treatments with low density groups having the largest fish and high density having the smallest fish, on average.

Strain Evaluation

Data associated with the first year of returns from fish released in 2011 as part of the strain evaluation were reported in the 2013 Resident Hatchery Research Report (Cassinelli and Koenig 2013). Overall, mean total catch for the Hayspur and Clear Springs groups in their second year-at-large were both 4.8% and differences in meant total catch from release through second year at large were not significant between the two strains. Comparisons of harvest and total catch for the five water bodies can be found in Table 4.

In 2012, Hayspur 2N were compared to Clear Springs 2N and Hayspur 3N were compared to Troutlodge 3N. For the 2N comparisons, mean total catch for the Hayspur strain was 13.6% while the Clear Springs strain was 21.4%. For the 3N comparisons, mean total catch for the Hayspur strain was 15.2% while the Troutlodge strain was 16.1%. Using Tukey's HSD Test, the Clear Springs 2N returns were significantly higher than the Hayspur 2N strain while the 3N groups were not statistically different.

Season of Release

We analyzed return rates across season of release for spring (March-May), summer (June-August), and fall (September-November) releases. Only releases into community ponds occurred during the winter (December-February), so we excluded winter releases from the analysis. For all water body types combined, fall (26.7%) and summer (26.4%) release groups had similar catch rates followed by spring (20.4%). Using Tukey's HSD Test, spring was significantly different than summer and fall seasons, while summer and fall were not different from each other. When rivers and community ponds were removed, there was minimal difference between seasons with summer (19.2%), fall (19.1%), and spring (18.2%) all having similar catch rates for lakes and reservoirs.

Size and Rank at Release

Continuing with the analysis we started with the fish released in 2011, we analyzed fish length and length-rank for fish released in 2012. Length of fish at tagging ranged from 109 to 398 mm, with 90% of fish between 210 and 300 mm. Length at tagging varied across release groups, and once again we evaluated both length at tagging and a fish's percent length rank within a release group. Length and rank were binned into 10% groups. From 200 mm (about 8 inches) to 330 mm (about 13 inches) there was roughly a 5% increase in catch rates for each 25 mm (1 inch) increase in length at tagging. Individual's percent length rank within a release group also showed correlation to catch rates. Contrary to 2011 when rank appeared to not play a role in return to creel and length was the major driver, 2012 data showed rank being the more prominent factor (Figure 8). Similar to 2011, in 2012 we ran a logistical procedure with only lakes/reservoirs data (since they represent the majority of release water bodies). In 2011, parameter estimates showed a one unit increase in rank resulted in a -0.04% decline in the probability of a tag return while a one unit increase in length increased tag return probability by 0.4%. In 2012, the same estimates flip-flopped and a one unit increase in rank increased tag return probability by 0.23% while a one unit increase in length only increased return probability by 0.13%.

Tag Reporting Rate

We released $50 reward tags across 11 waters, with three of these waters considered as community ponds. The statewide overall average tag reporting rate for catchable hatchery Rainbow Trout was 33.1%, which was down about 14% from the 2011 overall reporting rate.

DISCUSSION

Statewide Exploitation

Our estimates of overall statewide harvest (20.0%) and total catch (25.9%) of hatchery catchable trout released in 2012 are similar to the statewide estimates for fish released in 2011.

As in 2011, estimated total catch for community ponds varied widely across ponds (15% to 100%) in 2012. These results indicate a highly variable rate of urban pond use, but for the second year in a row overall urban pond catch rate (53.6%) was nearly double the catch rate for lakes, reservoirs, and rivers combined (23.8%). These results indicate that overall, community ponds play an important role in Idaho's fishery management and as a whole provide an efficient fishing opportunity for anglers in Idaho.

Much like in 2011, the mean number of days-at-large for catchables released into community ponds (21 days) and rivers (36 days) was much lower than for lakes/reservoirs (83 days) in 2012. Most community ponds are small water bodies that receive a high amount of fishing effort. The high amount of effort coupled with high total catch rates results in the majority of fish being caught in a short amount of time. In rivers, survival post stocking likely plays a large role in catch rates. High and Meyer (2009) found that 85% of radio tagged and 75% of T-bar anchor tagged catchable Rainbow Trout were no longer available to anglers four weeks post-stocking in an Idaho river. These results indicate that although overall total catch rates in rivers are relatively low (when compared to community ponds), the days-at-large also remain low because fish that are not caught in a short period of time have a low survival rate. Conversely, survival in the lakes and reservoirs we studied appears to be higher, as the mean days-at-large was nearly three months. This was further emphasized when looking at the returns of fish tagged and released in 2011, post 365 days-at-large. These results show second year catch rates of 0.3% for rivers, 0.3% for community ponds, and 3.7% for lakes/reservoirs.

Rearing Density

The effects of hatchery rearing density on salmonids are well documented in the literature. Increased rearing density is associated with detrimental effects. Decreased growth, weight, food conversion efficiency, and survival have been shown to occur during hatchery rearing for Coho Salmon (Fagerlund et al. 1981) and Cutthroat Trout (Kindschi and Koby 1994; Procarione et al. 1999). Fagerlund et al. (1981) reported that juvenile Coho Salmon raised at higher densities showed significant decreases in weight, length, condition factor, and food conversion efficiency, as well as higher mortality. Kindschi and Koby (1994) found similar results, with high densities (0.48–2.30 lb/ft^3/in) adversely affecting weight gain, feed conversion, survival, and fish health in Cutthroat Trout reared over 18 weeks. Procarione et al. (1999) showed Rainbow Trout reared at high densities (over 4 weeks) had lower growth and food conversion rates, but that high density itself was probably not a chronic stressor. Soderberg and Krise (1986) studied growth and survival of Lake Trout raised in circular tanks at four densities: 0.25, 0.50, 1.0, 2.0 lb/ft^3/in. They found mortality was higher at the highest density, but found no differences in growth over the 97 day experiment. Most published studies have focused on the in-hatchery impacts to fish health and growth, generally over time frames much shorter than the 10-12 months needed to produce a catchable-sized Rainbow Trout, with little study on how rearing conditions affect post-stocking survival or catch rates.

Some studies have examined how rearing density may affect post-stocking survival of salmonids, with most studies focusing on anadromous salmon species and little on Rainbow Trout. Elrod et al. (1989) found post-stocking survival of fingerling Lake Trout reared at a standard density was only 76% of those raised under low densities. Ewing and Ewing (1995) reported that increased hatchery rearing density produced lower percent survival to adulthood for Chinook Salmon in 14 of 15 brood years, but not in Coho Salmon. The authors speculated that longer rearing time at higher density could impose higher stress on hatchery fish. Generally, rearing density was negatively correlated with the percent survival of salmon smolts and subsequent adult returns. However, in most studies, the higher number of smolts produced offset the effects of greater density, providing more returned adults (Martin and Wertheimer 1989; Banks 1992; Banks and LaMotte 2002). Contrary to most salmon studies, Tipping et al. (2004) found no difference in adult survival of Steelhead Trout raised under reduced raceway loading and density. These authors recommended raising more fish (same raceways, higher densities) to increase adult Steelhead Trout return rates.

While our study is not directly measuring post-release survival, higher survival post-release should have a strong correlation with higher catch rates in a given water body. This should be especially apparent in a treatment based study with replication, where different treatment groups are released into the same water body at the same time. Varying post release survival among the groups should result in varying levels of return-to-creel.

For the second year in a row, our study showed total catch of catchable Rainbow Trout were highest for fish reared at lower densities. Similar to 2011, in 2012 the effect seemed most pronounced at Hagerman Fish Hatchery (Figure 6). However, returns by hatchery were not significantly different for the three hatcheries. Effects of rearing density probably interact with other factors such as water flow, disease loading, and water quality. These factors vary among hatcheries and complicate the relationship of rearing density to angler return rates, as certain relationships may only be applicable at individual facilities.

Results from both 2011 and 2012 releases indicate that fish raised at a lower density actually return to anglers at higher rates. For the most recent study year, the total catch of low-density treatment fish was 31.8% higher than high-density fish, on average. Increased survival associated with lower rearing density is well documented among studies of salmon returns (Martin and Wertheimer 1989; Banks 1992; Ewing and Ewing 1995; Banks and LaMotte 2002). However, as Martin and Wertheimer (1989) cautioned, “the adult return rate must be great enough to compensate for the reduced number of smolts produced.” In our study, the increase in total catch is not proportional to the decline in numbers of fish raised. A 50% decline in the number of fish raised would need to produce a 100% increase in total use to offset the fact that half as many fish were raised. Additionally, while loading fish at lower densities reduced overall feed costs (fewer fish to feed), overall operational costs are mostly unchanged and the cost-per-fish likely increased due to the fact that most facilities have fixed costs associated with pumping water and mechanized feeding, regardless of the rearing density.

As expected, rearing densities for 2012 releases fluctuated greatly over the rearing period, as well as between hatcheries. While all three hatcheries did a good job of achieving the specified separation goal of the density treatments (50%/75%/100% of the maximum treatment value), overall density treatments were lower than the designated treatment levels. This was especially true at American Falls and Hagerman fish hatcheries where treatment levels were about 65% of target treatment densities (Table 3). Overall, fish were reared at lower densities at American Falls and Hagerman fish hatcheries compared to Nampa Fish Hatchery, and Nampa achieved average density index values closest to the specified treatment levels. Additionally, lower density groups tended to be larger at release than high density groups. On average, fish released at low densities were 12 mm larger than fish released in high density groups. This difference was most pronounced at Hagerman Fish Hatchery where the low density group was, on average, 19 mm larger at release than the high density group. Given that we have noted a strong correlation between length at release and return to creel rates, the increased returns of low density groups could partially be explained by the increased size of these fish. While one could argue that the increased size at lower densities was simply a product of the increased rearing space and is simply a treatment effect, we did not observe a similar relationship between size and density in the 2011 study group.

Strain Evaluation

The 2011 comparison of Hayspur vs. Clearsprings Rainbow Trout was implemented by Hagerman Fish Hatchery as an on-station evaluation of in-hatchery survival and disease resistance. Tagging to evaluate return-to-creel was later added to compliment the in-hatchery work. Unfortunately, there was an oversight as to the ploidy level of the two strains and the Hayspur strain was diploid while the Clearsprings strain was triploid. Numerous studies have compared survival of diploid vs. triploid trout and lower survival after stocking for triploid salmonids (compared to their diploid counterparts) has been found in all-female Rainbow Trout fry (Brock et al. 1994), fingerling Rainbow Trout (Simon et al. 1993) and fingerling Coho Salmon (Rutz and Baer 1996). Previous IDFG research using mixed-sex Rainbow Trout (Hayspur strain) in lakes and reservoirs found significantly lower catch rates of triploids relative to diploids in the same water bodies (Koenig and Meyer 2011). Overall, the return of triploid trout in alpine lakes in Idaho was low compared to diploid trout, with diploids accounting for 68% of the total marked fish caught. Generally, a 1.5-2:1 ratio of diploid:triploid returns can be expected for mixed-sex Rainbow Trout, based on several years of stocking and surveys (Koenig et al. 2011). Releasing one strain that was diploid and one that was triploid likely confounded the results of this comparison. Similar to the first year of returns, the second year of returns from these diploid vs. triploid 2011 releases was not significantly different. However, we are unable to determine if the Clearsprings triploid trout had lower post-release survival but higher catch rates, resulting in similar overall return-to-creel reporting to the Hayspur diploid group.

In 2012, there were paired releases of diploid Hayspur and Clearsprings fish released, but some groups failed to receive tags (due to timing issues) resulting in a lower level of replication. The Clearsprings diploid groups had significantly higher return-to-creel rates than the diploid Hayspur group, but it is important to note that this comparison was only conducted in three water bodies. Additionally, four waters received triploid Troutlodge and triploid Hayspur strains for comparison. While the Troutlodge group has slightly higher returns, the difference was not significant. These comparisons are important, as IDFG resident fish hatcheries utilize all three strains (Clearsprings, Troutlodge, Hayspur). The Hayspur strain is reared in-house, while Clearsprings and Troutlodge strain are typically purchased as eyed eggs. Typically, egg quantities are driven by demand. Hayspur eggs are becoming more available due to advances and improvements at the Hayspur facility. Therefore, relative performance and return to creel of Hayspur versus commercial strains is important.

Season of Release

As part of the overall exploitation study, tagged trout releases occured throughout the year to encompass requested stocking schedules. We analyzed return-to-creel rates across season-of-release for spring, summer, and fall releases. In 2011, summer release groups had the highest catch rates followed by fall and then spring. In 2012, fall released had slightly higher returns followed closely by summer and then spring returns. This information continues to be important moving forward, as it will likely shape the timeframes for future stocking events at specific water bodies. Numerous water bodies show drastic return differences between spring, summer, and fall stocking events. If these types of water body-specific trends continue over time, stocking could be scheduled towards periods of higher return-to-creel rates, to improve overall catch rate of hatchery catchables.

Size and Rank at Release

Similar to 2011, in 2012 IDFG hatcheries met the goal of producing catchable Rainbow Trout at the requested 10-inch average length. However, while the average length of catchable trout was achieved, length was variable within and between hatcheries. Length-at-stocking is influenced by tagging date, rearing hatchery, and the rearing period, all of which can affect size throughout the stocking season. Catchable Rainbow Trout from McCall, Sandpoint, Mullan, Sawtooth, and Clearwater fish hatcheries originate from Nampa Fish Hatchery. Therefore, mean length at these facilities depends largely on the size distribution at Nampa Fish Hatchery at the time fish are transferred for redistribution. Little growth is expected after fish reach redistribution facilities. Regional average length of catchable trout should be directly related to the stocking and rearing hatchery. Variation in hatchery catchable Rainbow Trout length using current rearing techniques should be expected. Within any production lot, there is a genetic basis for slow growth in some fish (Westers 2001). Additionally, culture techniques to reduce size variation (such as hand-feeding, demand feeders, or grading) are not commonly employed in large IDFG facilities. However, moving into 2013 releases, grading of fish prior to release is being tested as a means to limit size variation and release larger, more consistently sized catchable Rainbow Trout.

Again in 2012, length of fish at tagging (and subsequent stocking) was highly correlated with angler catch rates (Figure 9). Similar to 2011, we showed that from eight to 12 inches, there is about a 10% increase in catch rate per one inch increase in length at stocking. Similarly, Yule et al. (2000) showed a direct correlation between larger size-at-stocking and increased return-to-creel for hatchery catchable Rainbow Trout stocked into two reservoirs. However, raising larger fish comes with a cost. Current work regarding the secondary objective of this research project (hatchery rearing techniques) is further evaluating the relationship between length/size-at-release and catch rates and exploring hatchery grading as a technique to help maximize the size-at-release/rearing cost relationship as well as reduce size variation.

The role that rank plays in return-to-creel is still not fully understood. Our results are somewhat contradictory in that the influence of raceway rank appeared negligible in 2011, yet appeared important in 2012. In 2013, we included some magnum (12 to 13 inch average length) catchables and we will expand the tagging of these fish moving into 2014. The increased size range of tagged releases will provide a better opportunity to further evaluate the size/rank relationship and get a better understanding as to the role each plays in influencing a fish's eventual return-to-creel rate.

Tag Reporting Rate

Prior to 2012, the overall tag reporting rate did not appear to be changing much from that reported previously by Meyer et al. (2012). They found the nonreward average reporting rate for hatchery trout was 49.4%. However, 2012 tags were reported at a rate of 33.1% in their first year at large. This represents nearly a 30.4% decrease in reporting rate from that of 2011 tags. While this decrease in reporting rate is not ideal as it may indicate anglers are growing less interested in returning tags, it is not all that alarming from a data collection standpoint because we continue to release reward tags yearly and will be able to further monitor and account for changing reporting rates on a year-to-year basis.

Anecdotal observations by IDFG staff have suggested the statewide average reporting rate may be significantly different from local reporting rates, which could result in site-specific biases in estimates of exploitation. If enough reward tags are returned, it may be possible to examine whether reporting rates differ across geographic regions of the state. Additionally, reporting rates of fish tagged in 2011 appeared to be correlated with fish size, with a higher reporting rate for larger fish. However, this relationship was not consistent in 2012.

RECOMMENDATIONS

1. Continue collecting and compiling tag returns.

    a. November 2014 will complete three years at large for the 2011 tag groups, two year at large for 2012 tags, and one year at large for 2014 tags.

2. Further evaluate statewide exploitation through continued tagging in release year 2014 across the top 50% to 60% (quantitatively) of waters stocked.

3. Further evaluate hatchery rearing techniques to assess if decreased size variation and a larger size-at-stocking are feasible rearing objectives resulting in a significant increase in return-to-creel.

a. Grading a subset of hatchery catchables prior to release in 2013 is currently being evaluated and this evaluation will be repeated during the 2014 release.

4. Determine is additional research is needed to compare Idaho's in-house Hayspur strain vs. various purchased commercial strains.

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Table 1. Total nonreward tags released by water body, hatchery, treatment and date in 2012. Harvest and Total Catch are shown as of October 30, 2013 with associated 90% confidence intervals (C.I.).

Region	Tag Coordinator	Water Body	Hatchery	Release Location	Tagging Date	Treatment	Tags Released	0-365 Days Post Release: Harvest Estimate	Harvest 90% C.I.	Total Catch Estimate	Total Catch 90% C.I.
1	Koenig Martin	Fernan Lake	Mullan	Fernan Lake	18-May-12	Production	193	5.0%	4.3%	7.0%	5.1%
					20-Sep-12	Production	200	24.0%	9.8%	27.8%	10.7%
		Post Falls Park P	Sandpoint	Post Falls Park P	20-Sep-12	Production	100	47.5%	18.4%	68.3%	22.1%
					23-May-12	Production	100	24.9%	13.3%	30.7%	14.8%
	Liter Mark	Calder P	Mullan	Calder P	18-May-12	Production	85	3.9%	5.2%	3.9%	5.2%
		Clee Creek P	Mullan	Clee Creek P	18-May-12	Production	100	9.6%	8.2%	15.3%	10.4%
		Day Rock P	Mullan	Day Rock P	17-May-12	Production	90	56.2%	20.2%	65.8%	21.9%
		Gold Creek P	Mullan	Gold Creek P	17-May-12	Production	99	0.0%		0.0%	
		Lucky Friday P	Mullan	Lucky Friday P	17-May-12	Production	98	31.3%	15.1%	33.3%	15.5%
		Steamboat P	Mullan	Steamboat P	17-May-12	Production	87	7.7%	7.4%	7.7%	7.4%
2	Bowersox Brett	Lake Waha	Hagerman	Lake Waha	18-Apr-12	Production	100	9.6%	8.2%	11.5%	9.0%
	Koenig Martin	Deer Creek Res	Clearwater	Deer Creek Res	10-May-12	Production	400	10.1%	4.6%	11.5%	4.9%
		Elk Creek Res	Clearwater	Various	20-Jun-12	Production	400	14.9%	5.7%	20.1%	6.9%
		Mann Lake	Hagerman	Mann Lake	04-Apr-12	High density	200	13.4%	7.1%	16.3%	7.9%
						Low density	200	12.5%	6.9%	17.3%	8.2%
						Medium density	200	18.2%	8.4%	23.0%	9.6%
			Lyons Ferry	Mann Lake	10-Oct-12	Production	400	0.0%		0.0%	
		Moose Creek Res	American Falls	Moose Creek Res	02-May-12	High density	200	12.5%	6.9%	12.5%	6.9%
						Low density	200	14.4%	7.4%	20.1%	8.9%
						Medium density	200	8.6%	5.6%	11.5%	6.6%
			Hagerman	Moose Creek Res	02-May-12	High density	200	8.6%	5.6%	9.6%	6.0%
						Low density	200	10.5%	6.3%	16.3%	7.9%
						Medium density	199	21.2%	9.2%	26.0%	10.3%
					22-Oct-12	Production	400	31.6%	9.3%	35.9%	10.1%
			Nampa	Moose Creek Res	24-Apr-12	High density	200	8.6%	5.6%	15.3%	7.7%
						Low density	200	13.4%	7.1%	18.2%	8.4%
						Medium density	199	14.5%	7.4%	18.3%	8.5%
						Production	100	7.7%	7.4%	15.3%	10.4%
		Soldier's Meadow Res	Hagerman	Soldier's Meadow Res	15-May-12	Hayspur 3N	200	1.9%	2.6%	1.9%	2.6%
						Troutlodge 3N	200	5.8%	4.6%	5.8%	4.6%
		Spring Valley Res	American Falls	Spring Valley Res	02-May-12	High density	200	13.4%	7.1%	15.3%	7.7%
						Low density	200	24.9%	10.0%	24.9%	10.0%
						Medium density	200	18.2%	8.4%	20.1%	8.9%
			Hagerman	Spring Valley Res	02-May-12	High density	200	22.0%	9.4%	26.8%	10.5%
						Low density	200	35.5%	12.3%	38.3%	12.9%
						Medium density	200	19.2%	8.7%	24.0%	9.8%
					22-Oct-12	Production	398	36.1%	10.2%	42.4%	11.4%
			Nampa	Spring Valley Res	01-May-12	High density	200	18.2%	8.4%	18.2%	8.4%
						Low density	200	14.4%	7.4%	18.2%	8.4%
						Medium density	200	14.4%	7.4%	17.3%	8.2%
		Winchester Lake	American Falls	Winchester Lake	18-Apr-12	High density	200	10.5%	6.3%	15.3%	7.7%
						Low density	199	19.3%	8.7%	24.1%	9.9%
						Medium density	200	20.1%	8.9%	24.0%	9.8%
			Hagerman	Winchester Lake	18-Apr-12	High density	200	15.3%	7.7%	18.2%	8.4%
						Low density	200	24.9%	10.0%	29.7%	11.1%
						Medium density	200	21.1%	9.1%	24.9%	10.0%
			Lyons Ferry	Winchester Lake	10-Oct-12	Production	400	17.2%	6.3%	19.6%	6.8%
			Nampa	Winchester Lake	18-Apr-12	High density	200	16.3%	7.9%	19.2%	8.7%
						Low density	199	29.9%	11.1%	33.7%	12.0%
						Medium density	199	26.0%	10.3%	27.9%	10.7%
3B	Butts Art	Kleiner P	Nampa	Kleiner P	21-Sep-12	Production	10	104.6%	58.9%	122.0%	58.5%
		Sage Hen Res	Nampa	Sage Hen Res	23-May-12	Feed Control	199	24.1%	9.9%	19.1%	8.6%
						Feed treatment	199	14.3%	7.4%	19.1%	8.6%
					25-Jun-12	Feed Control	200	15.3%	7.6%	18.2%	8.4%
						Feed treatment	200	15.3%	7.6%	18.1%	8.4%
		Succor Creek Res	Nampa	Succor Creek Res	23-May-12	Feed Control	200	2.9%	3.2%	2.9%	3.2%
						Feed treatment	200	2.9%	3.2%	2.9%	3.2%

Region	Tag Coordinator	Water Body	Hatchery	Release Location	Tagging Date	Treatment	Tags Released	0-365 Days Post Release			
								Harvest		Total Catch	
								Estimate	90% C.I.	Estimate	90% C.I.
3B	Koenig Martin	Arrowrock Res	Hagerman	Arrowrock Res	02-Oct-12	Production	398	15.9%	6.0%	17.3%	6.3%
		Boise River	Nampa	Americana	25-Jan-12	Production	50	0.0%		0.0%	
					02-Jul-12		40	33.6%	23.0%	38.3%	24.4%
					11-Oct-12		40	14.4%	15.6%	33.6%	23.0%
				Barber Park	25-Jan-12	Production	50	0.0%		0.0%	
					02-Jul-12		40	24.0%	19.8%	38.3%	24.4%
					11-Oct-12		40	19.2%	17.8%	43.1%	25.7%
				Boise State	25-Jan-12	Production	49	0.0%		0.0%	
					02-Jul-12		40	24.0%	19.8%	33.6%	23.0%
					11-Oct-12		40	14.4%	15.6%	14.4%	15.6%
				Eagle North	25-Jan-12	Production	50	0.0%		11.5%	12.5%
					02-Jul-12		20	19.2%	24.9%	67.1%	41.4%
					11-Oct-12		20	19.2%	24.9%	47.9%	36.8%
				Eagle South	25-Jan-12	Production	25	7.7%	14.5%	23.0%	24.3%
					02-Jul-12		20	19.2%	24.9%	28.8%	29.9%
					11-Oct-12		20	0.0%		9.6%	18.0%
				Glenwood	25-Jan-12	Production	50	0.0%		0.0%	
					02-Jul-12		40	43.1%	25.7%	43.1%	25.7%
					11-Oct-12		40	47.9%	26.9%	71.9%	31.5%
				Linder North	25-Jan-12	Production	25	7.7%	14.5%	7.7%	14.5%
					02-Jul-12		20	19.2%	24.9%	28.8%	29.9%
					11-Oct-12		20	19.2%	24.9%	47.9%	36.8%
				Linder South	25-Jan-12	Production	25	7.7%	14.5%	7.7%	14.5%
					02-Jul-12		20	38.3%	33.7%	38.3%	33.7%
					11-Oct-12		20	9.6%	18.0%	38.3%	33.7%
				Park Center	25-Jan-12	Production	50	0.0%		0.0%	
					02-Jul-12		40	19.2%	17.8%	28.8%	21.5%
					11-Oct-12		40	52.7%	28.0%	67.1%	30.7%
				Star	25-Jan-12	Production	50	7.7%	10.3%	7.7%	10.3%
					02-Jul-12		40	52.7%	28.0%	52.7%	28.0%
					11-Oct-12		40	4.8%	9.1%	24.0%	19.8%
		Caldwell Ps #2	Nampa	Caldwell P #2	15-Mar-12	Production	36	32.0%	23.7%	32.0%	23.7%
					04-Jun-12		36	42.6%	26.8%	47.9%	28.2%
					12-Oct-12		36	74.6%	33.3%	79.9%	34.1%
		Ed's P	Nampa	Ed's P	09-May-12	Production	25	46.0%	32.7%	46.0%	32.7%
					10-Oct-12		25	38.3%	30.3%	38.3%	30.3%
					22-Feb-12		25	69.0%	37.8%	69.0%	37.8%
		Horseshoe Bend P	Nampa	Horseshoe Bend P	19-Apr-12	Feed Control	59	9.7%	10.7%	13.0%	12.3%
						Feed treatment	50	11.5%	12.5%	11.5%	12.5%
					10-Oct-12	Production	125	15.3%	9.4%	23.0%	11.6%
		Lucky Peak Res	American Falls	Spring Shores	02-May-12	High density	200	23.0%	9.6%	34.5%	12.1%
						Low density	200	22.0%	9.4%	28.8%	10.9%
						Medium density	200	22.0%	9.4%	25.9%	10.3%
			Hagerman	Spring Shores	03-May-12	High density	200	12.5%	6.9%	20.1%	8.9%
						Low density	200	12.5%	6.9%	18.2%	8.4%
						Medium density	200	19.9%	8.8%	27.5%	10.6%
			Nampa	Spring Shores	03-May-12	High density	199	11.6%	6.6%	14.5%	7.4%
						Low density	200	10.5%	6.3%	15.3%	7.7%
						Medium density	200	9.6%	6.0%	21.1%	9.1%
		Manns Creek Res	Nampa	Manns Creek Res	23-Apr-12	Feed Control	100	21.1%	12.2%	21.1%	12.2%
						Feed treatment	100	5.8%	6.4%	13.4%	9.7%
						High density	200	16.3%	7.9%	18.2%	8.4%
						Low density	200	26.8%	10.5%	30.7%	11.3%
						Medium density	200	29.7%	11.1%	32.6%	11.7%
					16-Oct-12	Production	100	26.8%	13.8%	30.7%	14.8%
		Mountain Home Res	Hagerman	Mountain Home Res	09-May-12	Hayspur 3N	200	1.9%	2.6%	1.9%	2.6%
						Troutlodge 3N	200	2.9%	3.2%	2.9%	3.2%
		Park Center P	Nampa	Park Center P	14-Feb-12	Production	50	3.8%	7.3%	3.8%	7.3%
					03-Apr-12		50	23.0%	17.5%	49.9%	24.8%
					04-Jun-12		50	23.0%	17.5%	30.7%	20.0%
					12-Oct-12		50	11.5%	12.5%	30.7%	20.0%
		Sage Hen Res	Nampa	Sage Hen Res	12-Jun-12	High density	200	15.3%	7.7%	17.3%	8.2%
						Low density	200	20.1%	8.9%	23.0%	9.6%
						Medium density	200	17.3%	8.2%	23.0%	9.6%
						Production	100	15.3%	10.4%	28.8%	14.3%
		Sawyers P	Nampa	Sawyers P	22-Feb-12	Production	50	15.3%	14.4%	23.0%	17.5%
					19-Apr-12	Feed Control	25	7.7%	14.5%	15.3%	20.2%
						Feed treatment	25	7.7%	14.5%	7.7%	14.5%
					04-Jun-12	Production	50	7.7%	10.3%	19.2%	16.0%
					11-Oct-12		50	11.5%	12.5%	15.3%	14.4%

Region	Tag Coordinator	Water Body	Hatchery	Release Location	Tagging Date	Treatment	Tags Released	0-365 Days Post Release: Harvest Estimate	Harvest 90% C.I.	Total Catch Estimate	Total Catch 90% C.I.
3B	Koenig Martin	Wilson Springs P	Nampa	Wilson Springs P	09-Feb-12	Production	25	46.0%	32.7%	69.0%	37.8%
					22-Feb-12		25	61.4%	36.4%	76.7%	39.1%
					20-Apr-12		50	38.3%	22.1%	72.9%	29.1%
					02-Aug-12		50	46.0%	24.0%	49.9%	24.8%
					03-Oct-12		50	38.3%	22.1%	57.5%	26.4%
	Kozfkay Joe	Crane Falls Res	Hagerman	Crane Falls Res	11-Apr-12	Production	200	9.5%	5.9%	16.2%	7.9%
		Manns Creek Res	Nampa	Manns Creek Res	14-May-12	Feed Control	198	22.2%	9.4%	25.1%	10.1%
						Feed treatment	199	20.1%	8.9%	21.1%	9.1%
3M	Koenig Martin	Horsethief Res	American Falls	Horsethief Res	23-May-12	High density	200	16.3%	7.9%	18.2%	8.4%
						Low density	199	19.3%	8.7%	27.9%	10.7%
						Medium density	200	24.9%	10.0%	29.7%	11.1%
			Hagerman	Horsethief Res	22-May-12	High density	200	20.1%	8.9%	25.9%	10.3%
						Low density	200	35.5%	12.3%	40.3%	13.3%
						Medium density	200	28.8%	10.9%	34.5%	12.1%
						Production	100	24.9%	13.3%	30.7%	14.8%
			Nampa	Horsethief Res	23-May-12	High density	200	16.3%	7.9%	19.2%	8.7%
						Low density	200	10.5%	6.3%	12.5%	6.9%
						Medium density	200	13.4%	7.1%	15.3%	7.7%
					10-Oct-12	Production	400	42.7%	11.4%	47.0%	12.2%
		Warm Lake	Nampa	Warm Lake	25-Jun-12	Feed Control	100	15.3%	10.4%	19.2%	11.7%
						Feed treatment	100	13.4%	9.7%	23.0%	12.8%
						High density	200	21.1%	9.1%	24.9%	10.0%
						Low density	200	20.1%	8.9%	25.9%	10.3%
						Medium density	200	19.2%	8.7%	23.0%	9.6%
4	Koenig Martin	Anderson Ranch Res	Hagerman	Anderson Ranch Res	23-May-12	High density	200	9.6%	6.0%	11.5%	6.6%
						Low density	200	12.5%	6.9%	17.3%	8.2%
						Medium density	200	13.4%	7.1%	18.2%	8.4%
		Camas P 3	Nampa	Camas P 3	03-May-12	Production	70	30.1%	17.1%	38.3%	19.1%
					03-Jul-12		70	35.6%	18.5%	35.6%	18.5%
		Dog Creek Res	Hagerman	Dog Creek Res	01-Oct-12	Clearsprings 2N	99	23.2%	12.9%	34.9%	15.8%
						Hayspur 2N	100	23.0%	12.8%	26.8%	13.8%
					27-Mar-12	Hayspur 3N	100	24.9%	13.3%	40.3%	17.0%
						Troutlodge 3N	100	24.9%	13.3%	34.5%	15.7%
		Filer / LQ Drain P	Hagerman	Filer / LQ Drain P	13-Jun-12	Production	51	56.4%	26.0%	63.9%	27.4%
					17-Sep-12		100	26.8%	13.8%	32.6%	15.2%
					22-Oct-12		50	7.7%	10.3%	11.5%	12.5%
		Frank Oster Lake #1	Hagerman	Frank Oster Lake #1	09-Mar-12	Hayspur 3N	50	53.7%	25.6%	65.2%	27.8%
						Yellow trout	50	42.2%	23.1%	53.7%	25.6%
		Lake Creek Lake	Nampa	Lake Creek Lake	03-May-12	Production	75	17.9%	12.8%	25.6%	15.3%
					03-Jul-12		75	33.2%	17.4%	40.9%	19.2%
		Lake Walcott	Hagerman National	Lake Walcott	09-Oct-12	Production	399	9.1%	4.3%	10.1%	4.6%
		Little Camas Res	American Falls	Little Camas Res	09-May-12	High density	200	11.5%	6.6%	14.4%	7.4%
						Low density	200	19.1%	8.6%	22.9%	9.5%
						Medium density	200	12.5%	6.9%	15.3%	7.7%
			Hagerman	Little Camas Res	09-May-12	High density	199	13.5%	7.2%	19.3%	8.7%
						Low density	200	22.0%	9.4%	28.8%	10.9%
						Medium density	200	29.7%	11.1%	33.6%	11.9%
			Nampa	Little Camas Res	09-May-12	High density	200	19.2%	8.7%	21.1%	9.1%
						Low density	200	14.4%	7.4%	19.2%	8.7%
						Medium density	200	18.2%	8.4%	20.1%	8.9%
		Little Wood Res	Nampa	Little Wood Res	25-Jun-12	High density	200	2.9%	3.2%	2.9%	3.2%
						Low density	200	2.9%	3.2%	3.8%	3.7%
						Medium density	200	2.9%	3.2%	3.8%	3.7%
		Riley Creek P	Hagerman	Riley Creek P	29-Feb-12	Production	97	62.6%	21.4%	82.2%	24.6%
					14-Jun-12	Production	99	44.5%	17.9%	48.4%	18.7%
					17-Sep-12	Production	100	38.3%	16.5%	47.9%	18.5%
		Roseworth Res	Hagerman	Roseworth Res	27-Mar-12	High density	200	2.9%	3.2%	5.8%	4.6%
						Low density	200	7.7%	5.3%	10.5%	6.3%
						Medium density	200	9.6%	6.0%	13.4%	7.1%
		Salmon Falls Creek Res	Hagerman	Salmon Falls Creek Res	09-Oct-12	Clearsprings 3N	200	12.5%	6.9%	15.3%	7.7%
						Hayspur 2N	400	4.8%	3.0%	7.7%	3.9%
					13-Apr-12	Production	400	5.8%	3.3%	7.2%	3.8%
		Thorn Creek Res	Hagerman	Thorn Creek Res	15-May-12	Hayspur 3N	200	6.7%	5.0%	11.5%	6.6%
						Troutlodge 3N	199	6.7%	5.0%	11.6%	6.6%

Region	Tag Coordinator	Water Body	Hatchery	Release Location	Tagging Date	Treatment	Tags Released	0-365 Days Post Release: Harvest Estimate	Harvest 90% C.I.	Total Catch Estimate	Total Catch 90% C.I.
5	Brimmer Arnie	American Falls Res	Rangen	Sportmans Park	30-May-12	Rangen hatchery	827	2.1%	1.4%	2.8%	1.6%
	Koenig Martin	American Falls Res	American Falls	Sportsmans Park	04-Apr-12	High density	200	8.6%	5.6%	10.5%	6.3%
						Low density	200	8.6%	5.6%	10.5%	6.3%
						Medium density	200	8.6%	5.6%	10.5%	6.3%
				American Falls Res	15-Oct-12	Production	400	1.0%	1.3%	1.0%	1.3%
		Bear River	Grace	Lower sites (3)	04-Apr-12	Production	75	27.4%	15.6%	52.3%	21.3%
					18-Apr-12		150	19.0%	9.7%	39.4%	14.4%
					09-Jun-12		75	0.0%		5.1%	6.9%
					22-Jun-12		75	5.1%	6.9%	5.1%	6.9%
					06-Sep-12		73	2.6%	5.0%	21.0%	14.1%
					19-Sep-12		150	8.9%	6.6%	44.7%	15.5%
				Upper sites (1) below Alexander Dam	18-Apr-12	Production	25	0.0%		0.0%	
					19-Sep-12		25	0.0%		0.0%	
				Upper sites (4)	22-Jun-12	Production	25	0.0%		0.0%	
		Blackfoot Res	American Falls	Blackfoot Res	15-Oct-12	Production	400	3.8%	2.7%	5.3%	3.2%
		Chesterfield Res	Hagerman	Chesterfield Res	23-May-12	High density	200	1.9%	2.6%	1.9%	2.6%
						Low density	200	1.9%	2.6%	1.9%	2.6%
						Medium density	200	1.9%	2.6%	1.9%	2.6%
					22-Oct-12	Production	400	2.9%	2.3%	14.8%	5.7%
		Deep Creek Res	Hagerman	Deep Creek Res	10-May-12	High density	200	1.0%	1.8%	1.9%	2.6%
						Low density	200	8.6%	5.6%	9.6%	6.0%
						Medium density	200	3.8%	3.7%	4.8%	4.2%
		Devils Creek Res	Hagerman	Devils Creek Res	10-May-12	High density	200	6.7%	5.0%	8.6%	5.6%
						Low density	200	16.3%	7.9%	19.2%	8.7%
						Medium density	200	9.6%	6.0%	11.5%	6.6%
						Production	100	0.0%		1.9%	3.7%
6	Koenig Martin	Birch Creek	Mackay	Birch Creek	25-May-12	Production	200	29.6%	11.0%	43.9%	13.9%
					06-Jul-12	Production	198	24.2%	9.9%	28.1%	10.8%
		Island Park Res	Hagerman	Island Park Res	22-May-12	High density	200	0.0%		0.0%	
						Low density	200	1.0%	1.8%	2.9%	3.2%
						Medium density	200	1.0%	1.8%	1.0%	1.8%
					01-Oct-12	Clearsprings 2N	200	1.9%	2.6%	2.9%	3.2%
						Hayspur 2N	200	1.9%	2.6%	2.9%	3.2%
						Troutlodge 3N	200	0.0%		1.0%	1.8%
		Jim Moore Pond	American Falls	Jim Moore Pond	15-Oct-12	Production	100	17.3%	11.1%	24.9%	13.3%
		Mackay Res	American Falls	Boat Ramp	10-May-12	High density	201	10.5%	6.2%	12.4%	6.8%
						Low density	200	11.5%	6.6%	14.4%	7.4%
						Medium density	199	3.9%	3.7%	9.6%	6.0%
			Mackay	Mackay Res	31-May-12	Production	200	21.1%	9.1%	22.0%	9.4%
		Roberts Gravel Pond	American Falls	Roberts Gravel P	09-May-12	Production	100	32.6%	15.2%	34.5%	15.7%
		Ryder Park P	Mackay	Ryder Park P	08-Jun-12	Production	100	44.1%	17.8%	53.7%	19.6%
					19-Sep-12		100	34.5%	15.7%	38.3%	16.5%
		Snake River Henry's Fork	Ashton	Outlet	24-Jul-12	Production	50	7.7%	10.3%	7.7%	10.3%
				Macks Inn	22-May-12	Production	200	11.5%	6.6%	20.1%	8.9%
					24-Jul-12		50	11.5%	12.5%	11.5%	12.5%
					10-Jul-12		98	7.8%	7.5%	15.7%	10.6%
		Star Hope Lake	Mackay	Star Hope Lake	19-Jul-12	Production	20	0.0%		0.0%	
	Schoby Greg	Blue Creek Res	Ashton	Blue Creek Res	21-May-12	Production	100	28.8%	14.3%	30.7%	14.8%
					07-Jun-12		100	24.9%	13.3%	26.8%	13.8%
		East Harriman P	Ashton	East Harriman P	19-Jun-12	Production	75	15.3%	11.9%	20.5%	13.7%
					10-Jul-12		75	20.5%	13.7%	38.3%	18.6%
		Rigby Lake	Ashton	Rigby Lake	11-Sep-12	Production	125	19.9%	10.8%	24.5%	12.0%
					12-Jun-12		126	35.0%	14.4%	48.7%	17.2%
		Snake River (upper)	Ashton	Snake River Idaho Falls	15-May-12	Production	59	19.5%	15.0%	22.7%	16.1%
		Stoddard Mill P	Ashton	Stoddard Mill P	07-Jun-12	Production	19	20.2%	26.2%	20.2%	26.2%
					10-Jul-12		10	19.2%	35.0%	19.2%	35.0%
					24-Jul-12		10	19.2%	35.0%	38.3%	47.1%
					08-Aug-12		10	19.2%	35.0%	57.5%	54.4%
					21-Aug-12		10	19.2%	35.0%	57.5%	54.4%
					05-Sep-12		10	19.2%	35.0%	38.3%	47.1%
					18-Sep-12		10	38.3%	47.1%	38.3%	47.1%

Region	Tag Coordinator	Water Body	Hatchery	Release Location	Tagging Date	Treatment	Tags Released	0-365 Days Post Release			
								Harvest		Total Catch	
								Estimate	90% C.I.	Estimate	90% C.I.
7	Koenig Martin	Hyde P	Mackay	Hyde P	07-Jun-12	Production	25	23.0%	24.3%	30.7%	27.6%
					08-Nov-12		24	0.0%		32.0%	28.6%
		Salmon River	Sawtooth	Section 5 - Slate Creek to Yankee Fork	18-Jun-12	Production	56	17.1%	14.4%	20.5%	15.7%
				Section 6 - Yankee Fork to Valley Ck			172	16.7%	8.6%	20.1%	9.5%
				Section 7 - Valley Ck to Redfish Ck			56	10.3%	11.2%	13.7%	12.9%
				ection 8 - Redfish Ck to Hell Roaring (			114	11.8%	8.6%	20.2%	11.3%
				Section 7 - Valley Ck to Redfish Ck	11-Sep-12	Production	75	2.6%	4.9%	2.6%	4.9%
				ection 8 - Redfish Ck to Hell Roaring (			50	3.8%	7.3%	3.8%	7.3%
		Stanley Lake	Nampa	Put-in	12-Jun-12	Feed Control	100	15.2%	10.3%	24.7%	13.2%
						Feed treatment	100	1.9%	3.7%	9.6%	8.2%
						High density	200	5.8%	4.6%	11.5%	6.6%
						Low density	200	7.7%	5.3%	11.5%	6.6%
						Medium density	200	16.3%	7.9%	30.7%	11.3%

Table 2. List of waters, by region and stratified by perceived harvest (low/medium/high), used to evaluate return-to-creel of hatchery catchable Rainbow Trout in "community ponds" statewide. Locations to receive tags were chosen to encompass most regions and assigned on a 3-year rotation with reward tags in each stratum. Tag numbers outlined with boxes indicate receiving reward tags.

Region	Water	Stocked	Tags 2011	Tags 2012	Tags 2013
		Low			
03B	Caldwell P #2	2,400		250	
03B	Caldwell P #3	2,000			
03B	Duff Lane Pond	1,000			250
03B	Eagle Island Park Pond	4,500	250		
03B	Quinn Pond	4,500			
03B	Veterans Pond	4,000			
4	Connor Pond	1,000	250		
4	Emerald Lake	6,000			
6	Rigby Lake	5,000			250
Region	Water	Stocked	Tags 2011	Tags 2012	Tags 2013
		Medium			
1	Crystal Lake	3,000	250		
03B	Caldwell City P	5,000	250		
03B	Ed's Pond	1,750		250	
03B	Horseshoe Bend Mill P	6,000		250	
03B	Merrill Park P	5,000			
03B	Payette Greenbelt P	3,500			250
03B	Sego Prairie P	1,750			
03M	Browns P	4,450			
03M	Council Park P	2,000			250
4	Camas P #02	3,000		250	
4	Dierkes lake	7,000	200		
4	Dollar Lake	600			
4	Featherville Dredge P	6,000	150		
4	Penny Lake	2,900			
4	Rupert Gravel Pond	2,000	250		
6	Rexburg City P	3,600			
6	Roberts Gravel P	5,400		250	
7	Kids Creek P	2,400	250		
Region	Water	Stocked	Tags 2011	Tags 2012	Tags 2013
		High			
1	Post Falls Park P	4,000		250	
2	Hordemann P	850	175		250
2	Robinson P	7,750	275		
2	Snake River Levee P	8,550	200		
03B	Marsing Hwy P	6,000			
03B	McDevitt P	7,500	275		
03B	Park Center	8,000		275	
03B	Riverside	7,200			275
03B	Sawyers P	7,500		275	
03B	Settlers Park P	2,400			
03B	Ten Mile P	5,250			275
03B	Weiser Community P	4,200			
03M	Fischer P	5,000			250
03M	Rowlands P	6,000	250		
4	Filer P	7,600		250	
4	Freedom Park P (Burley)	1,500	150		
4	Heagle Park P	500			250
4	Lake Creek L	2,100		250	
6	Ryder Park P	5,000		250	
6	Trail Creek P	3,600	250		
7	Blue Mountain Meadow P	1,500			
7	Hyde P	800		250	

Table 3. Mean density index (DI, lbs fish/ft^3/inch), flow index (FI, lbs/GPM/inch) across the entire rearing period by hatchery and treatment for tagged catchable Rainbow Trout in 2011 and 2012. Length is the mean total length (mm) at the time of stocking (with 95% confidence intervals).

Release Year	Treatment	American Falls			Hagerman			Nampa			Overall Mean Length (mm)
		DI	FI	Length (mm)	DI	FI	Length (mm)	DI	FI	Length (mm)	
2011	Low	0.10	0.32	257 (± 1)	0.10	0.50	266 (± 1)	0.13	0.29	257 (± 1)	247 (± 1)
	Medium	0.13	0.49	255 (± 1)	/	/	/	0.20	0.50	251 (± 1)	258 (± 1)
	High	0.16	0.67	253 (± 1)	0.21	0.79	266 (± 1)	0.25	0.59	242 (± 1)	253 (± 1)
	Overall avg.			254 (± 1)			253 (± 1)			252 (± 1)	253 (± 1)
2012	Low	0.09	0.36	251 (± 1)	0.11	0.54	271 (± 1)	0.11	0.26	242 (± 1)	256 (± 1)
	Medium	0.15	0.56	249 (± 1)	0.15	0.66	261 (± 1)	0.18	0.48	247 (± 1)	253 (± 1)
	High	0.19	0.59	241 (± 1)	0.19	0.84	252 (± 1)	0.24	0.49	238 (± 1)	244 (± 1)
	Overall avg.			247 (± 1)			261 (± 1)			242 (± 1)	251 (± 1)

Table 4. Strain evaluation comparisons for release year 2011 and 2012 including first and second year-at-large catch and harvest from 2011 releases and first year-at-large catch and harvest from 2012 releases (with 90% confidence intervals).

Year	Region	Water Body	Date	Strain	Number Released	0 - 365 Days Post-Release				366 - 730 Days Post-Release			
						Harvest		Catch		Harvest		Catch	
						Est.	90% C.I.	Est.	90% C.I.	Est.	90% C.I.	Est.	90% C.I.
2011	3B	Mann Lake	12-Oct-11	Clearsprings 2N	100	1.9%	3.8%	3.8%	5.4%	0.0%	-	0.0%	-
				Hayspur 3N	99	0.0%	-	1.9%	3.8%	0.0%	-	0.0%	-
		Mountain Home Res	12-Oct-11	Clearsprings 2N	100	9.6%	8.5%	17.3%	11.4%	6.8%	12.2%	6.8%	12.2%
				Hayspur 3N	100	19.2%	12.1%	19.2%	12.1%	3.4%	8.5%	3.4%	8.5%
	3M	Cascade Res	31-Oct-11	Clearsprings 2N	200	1.9%	2.7%	2.9%	3.3%	3.4%	6.1%	3.4%	6.1%
				Hayspur 3N	200	1.0%	1.9%	1.9%	2.7%	5.1%	7.7%	5.1%	7.7%
	4	Dierke's Lake	11-Oct-11	Clearsprings 2N	95	12.1%	9.8%	40.4%	18.0%	0.0%	-	0.0%	-
				Hayspur 3N	99	23.2%	13.4%	48.4%	19.4%	3.4%	8.6%	3.4%	8.6%
		Magic Res	2-Nov-11	Clearsprings 2N	199	15.4%	8.0%	25.1%	10.5%	11.9%	12.8%	13.6%	13.9%
				Hayspur 3N	200	15.3%	8.0%	23.0%	10.0%	11.9%	12.7%	11.9%	12.7%
2012	2	Soldier Meadow Res	15-May-12	Hayspur 3N	200	2.9%	2.6%	2.9%	2.6%	/	/	/	/
				Troutlodge 3N	200	8.6%	4.6%	8.6%	4.6%	/	/	/	/
	3B	Mountain Home Res	9-May-12	Hayspur 3N	200	2.9%	2.6%	2.9%	2.6%	/	/	/	/
				Troutlodge 3N	200	4.3%	3.2%	4.3%	3.2%	/	/	/	/
	4	Dog Creek Res	27-Mar-12	Hayspur 3N	100	37.4%	13.3%	60.5%	16.9%	/	/	/	/
				Troutlodge 3N	100	37.4%	13.3%	51.9%	15.7%	/	/	/	/
			1-Oct-12	Clearsprings 2N	99	34.9%	12.9%	52.4%	15.8%	/	/	/	/
				Hayspur 2N	100	34.6%	12.8%	40.3%	13.8%	/	/	/	/
		Salmon Falls Creek Res	9-Oct-12	Clearsprings 2N	200	18.7%	6.9%	23.0%	7.7%	/	/	/	/
				Hayspur 2N	400	7.2%	3.0%	11.5%	3.9%	/	/	/	/
		Thorn Creek Res	15-May-12	Hayspur 3N	200	10.1%	5.0%	17.3%	6.6%	/	/	/	/
				Troutlodge 3N	199	10.1%	5.0%	17.4%	6.6%	/	/	/	/
	6	Island Park Res	1-Oct-12	Clearsprings 2N	200	2.9%	2.6%	4.3%	3.2%	/	/	/	/
				Hayspur 2N	200	2.9%	2.6%	4.3%	3.2%	/	/	/	/
				Troutlodge 3N	200	0.0%	-	1.4%	1.8%	/	/	/	/

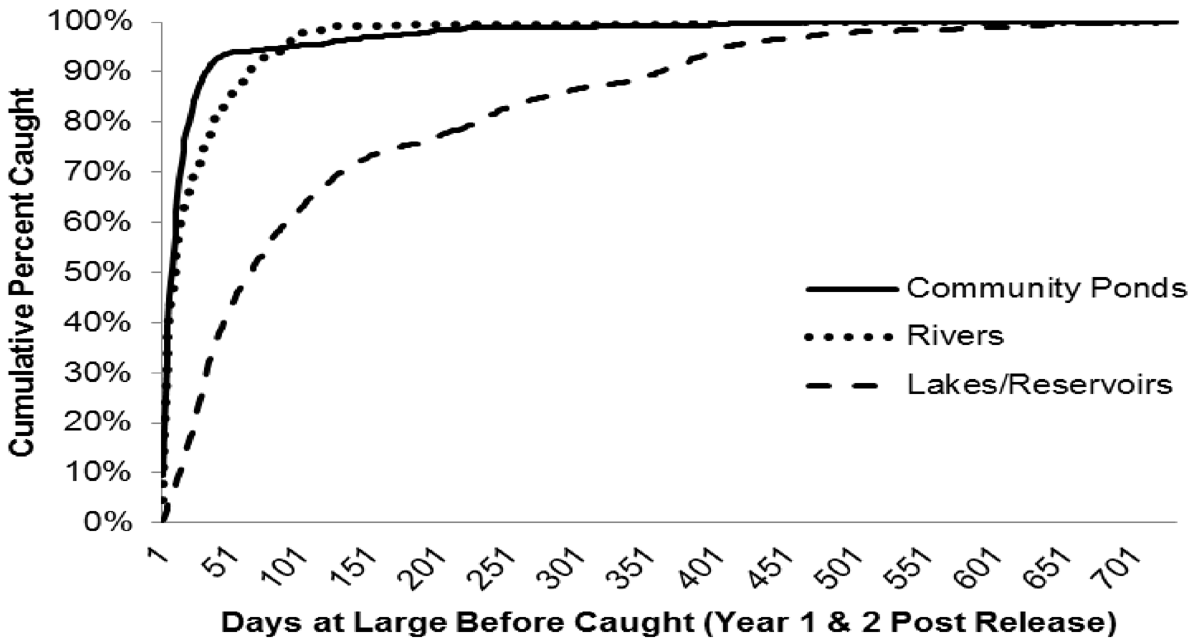

Figure 1. Cumulative percentage caught versus days-at-large (in first two years at large) for tagged hatchery catchable trout that were released in lakes/reservoirs, community ponds, and rivers in 2011 and were subsequently caught.

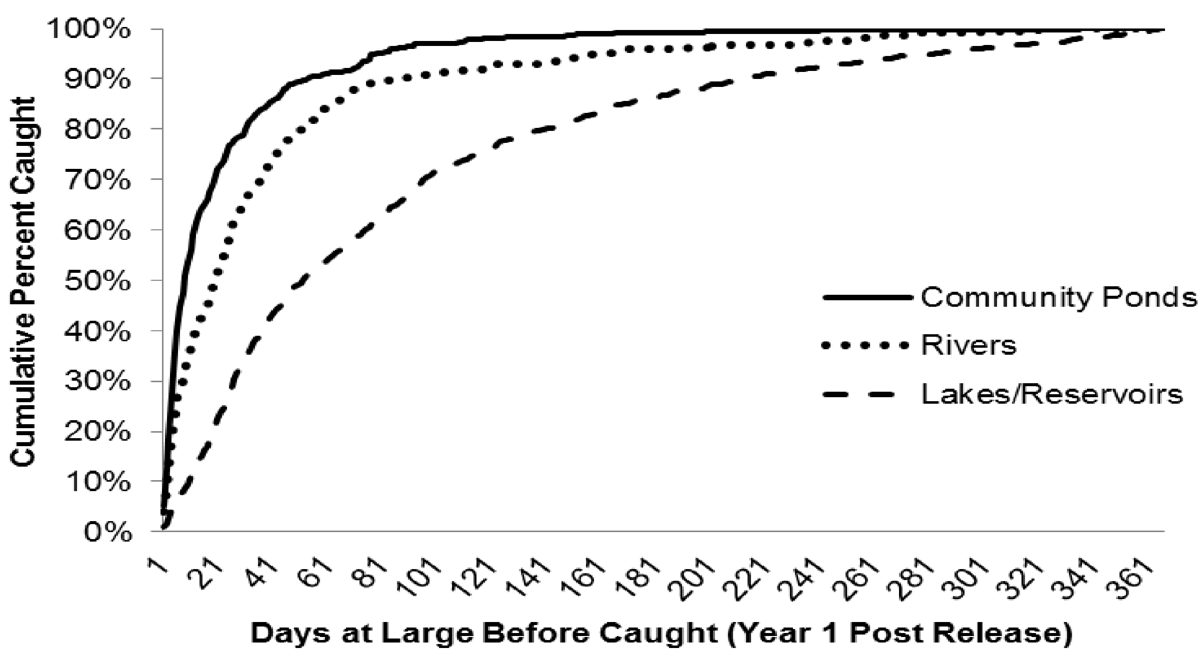

Figure 2. Cumulative percentage caught versus days-at-large (in first year at large) for tagged hatchery catchable trout that were released in lakes/reservoirs, community ponds, and rivers in 2012 and subsequently caught.

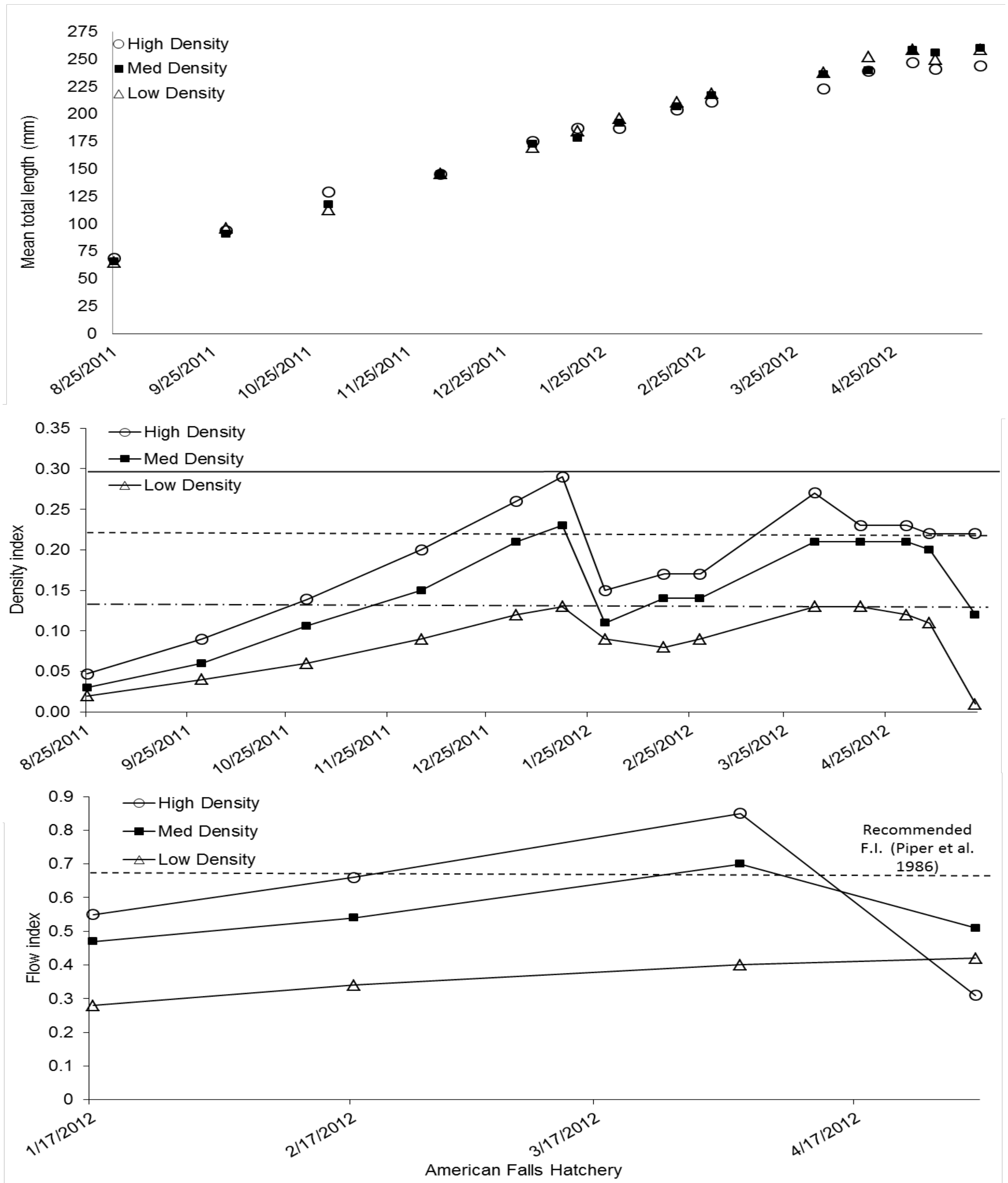

Figure 3. Mean total length (mm), density index (lbs/ft^3/inch), and flow index (lbs/inch x gal/min) by treatment (high/med/low density) during the rearing period for American Falls Hatchery in 2012.

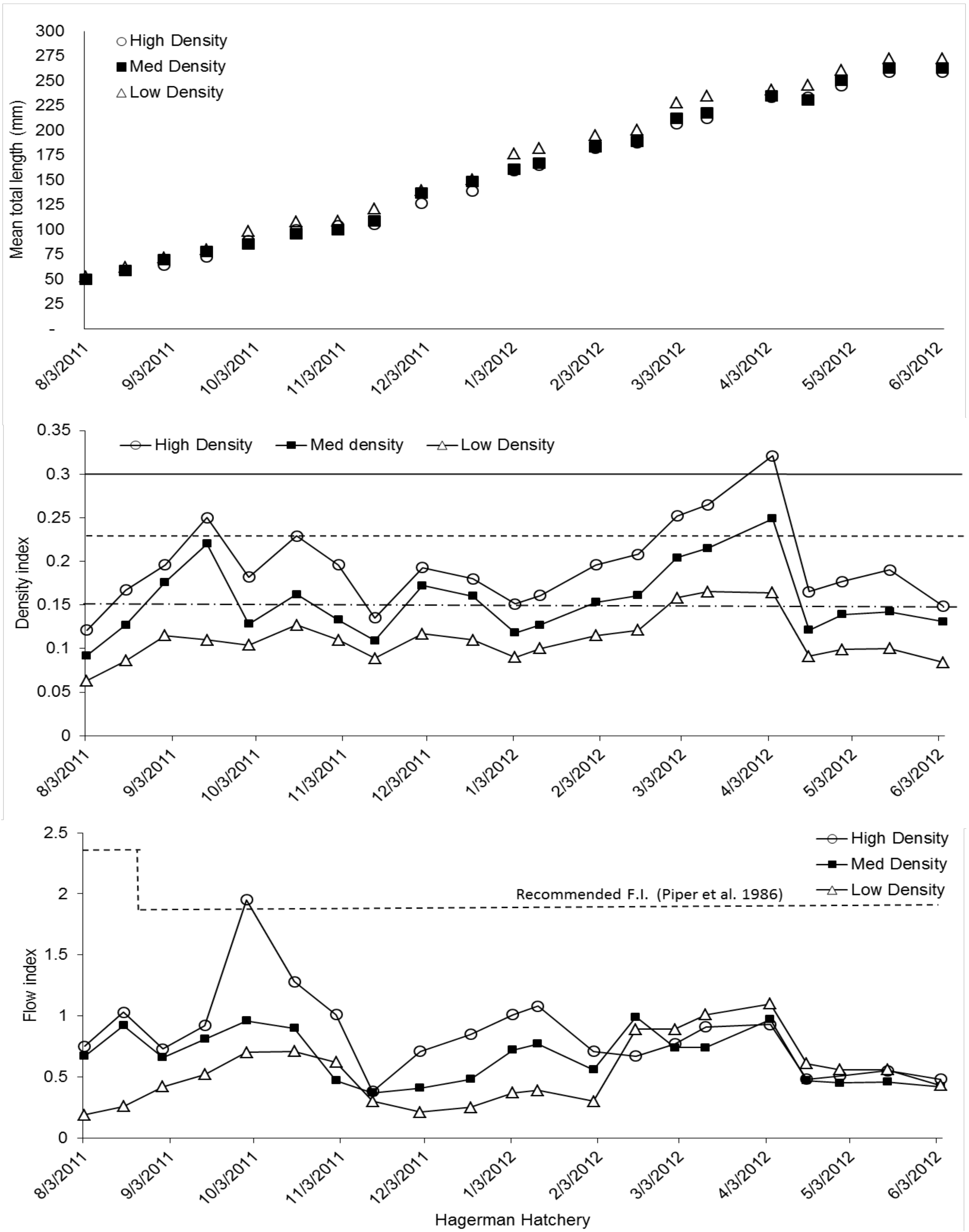

Figure 4. Mean total length (mm), density index (lbs/ft^3/inch), and flow index (lbs/inch x gal/min) by treatment (high/med/low density) during the rearing period for Hagerman Hatchery in 2012.

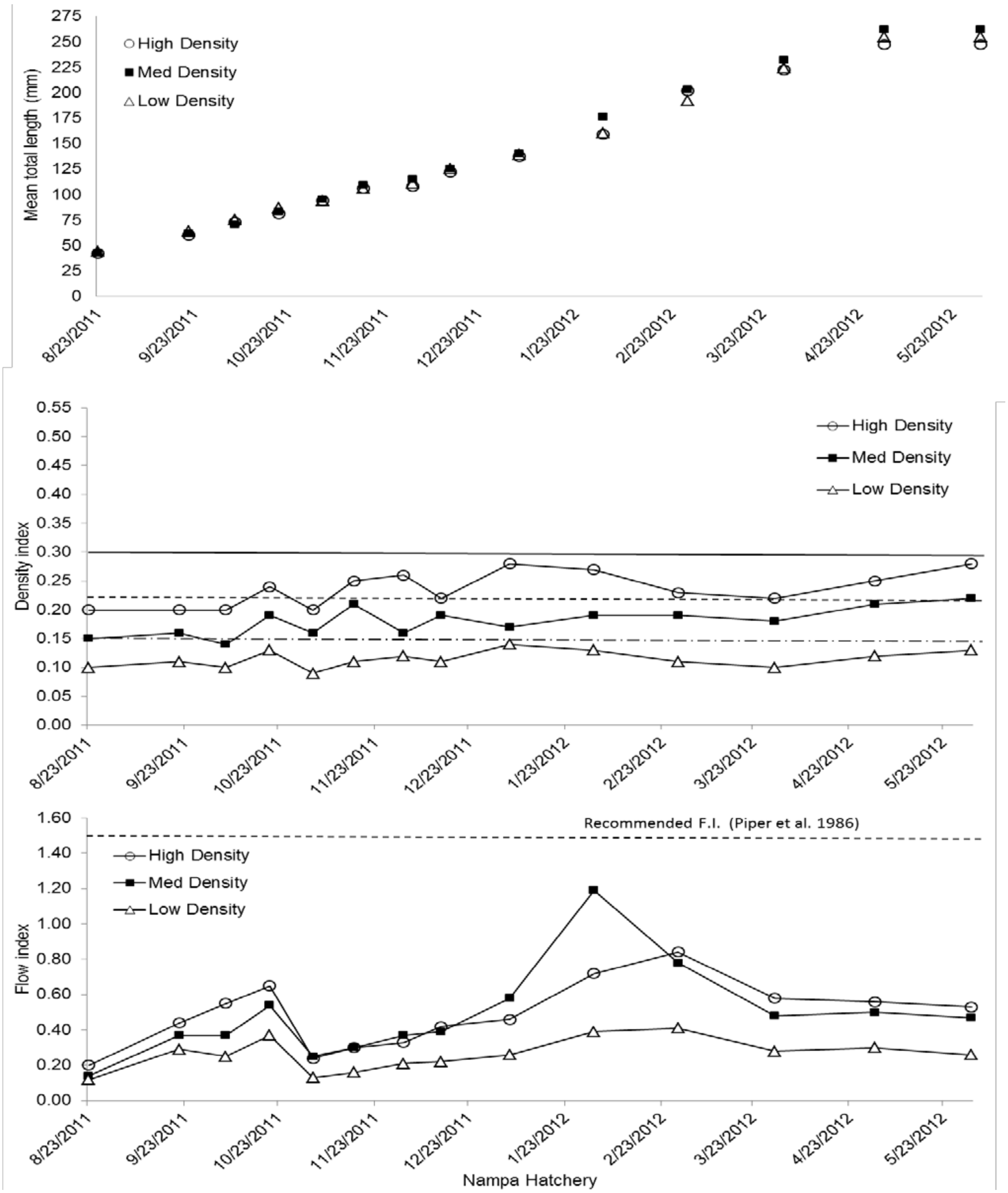

Figure 5. Mean total length (mm), density index (lbs/ft^3/inch), and flow index (lbs/inch x gal/min) by treatment (high/med/low density) during the rearing period for Nampa Hatchery in 2012.

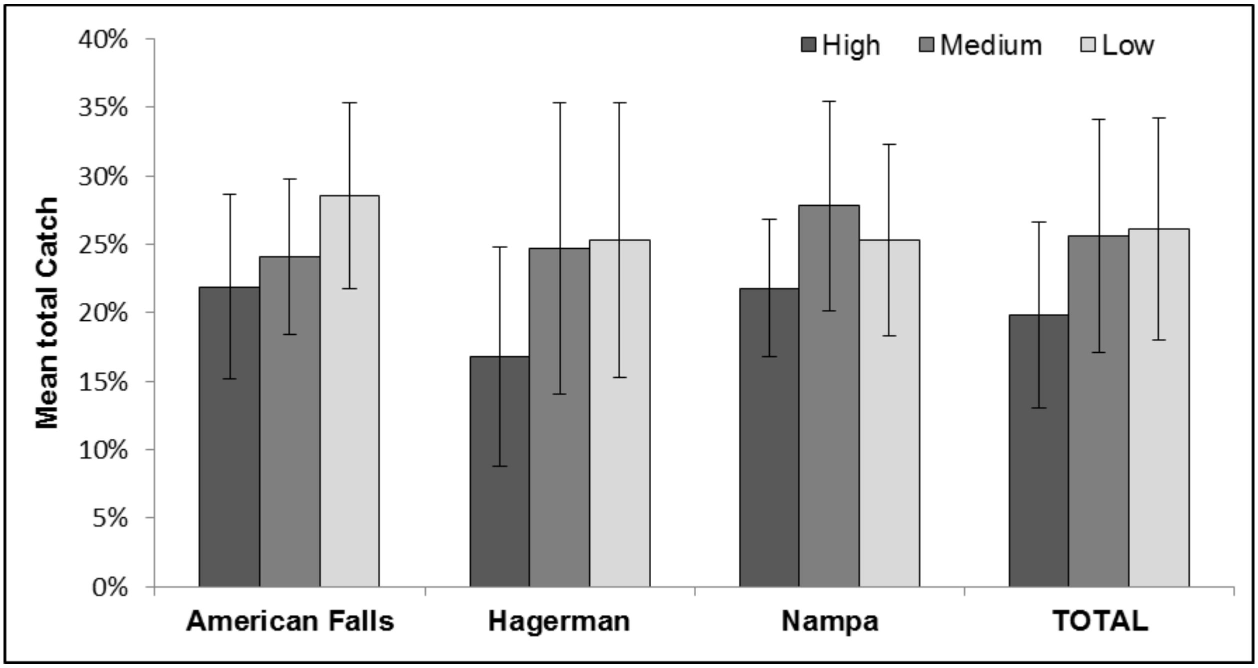

Figure 6. Mean total catch of catchable Rainbow Trout reared at high (0.30 lbs/ft^3/in), medium (0.23 lbs/ft^3/in), and low (0.15 lbs/ft^3/in) densities across three different hatcheries in 2012.

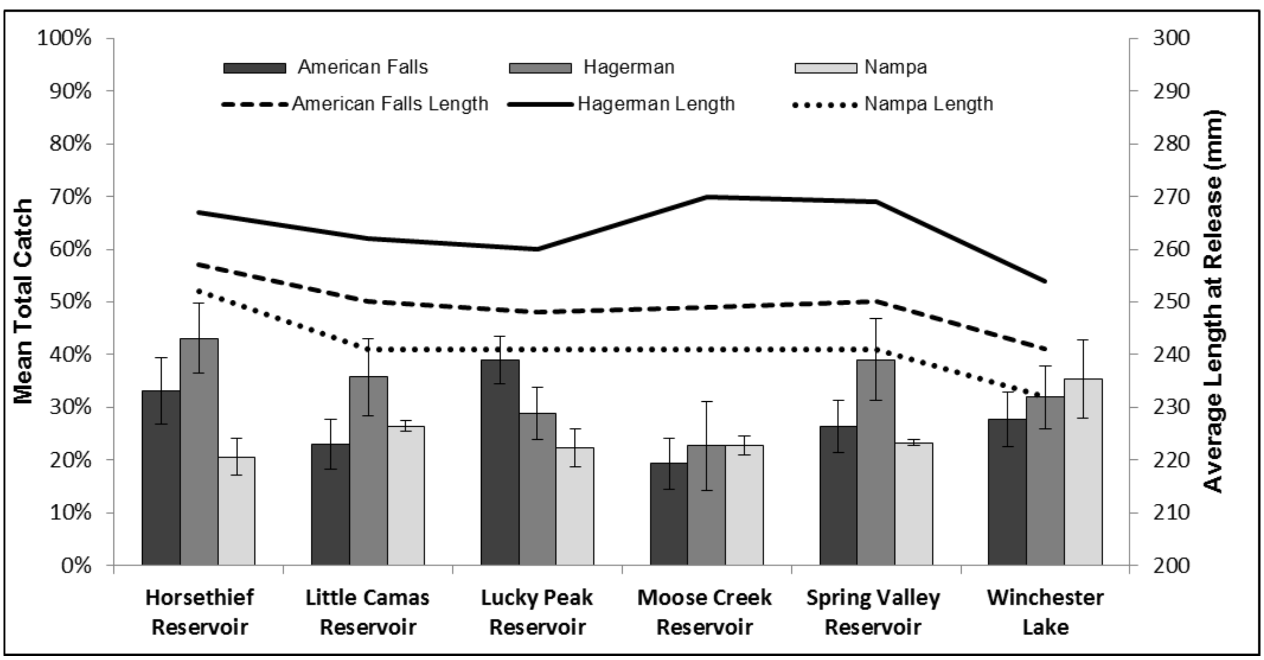

Figure 7. Mean total catch (bars) of hatchery catchable trout released from American Falls, Hagerman, and Nampa fish hatcheries into six lakes/reservoirs in 2012. Mean length at release (lines) for each hatchery/release location is plotted on the secondary Y axis.

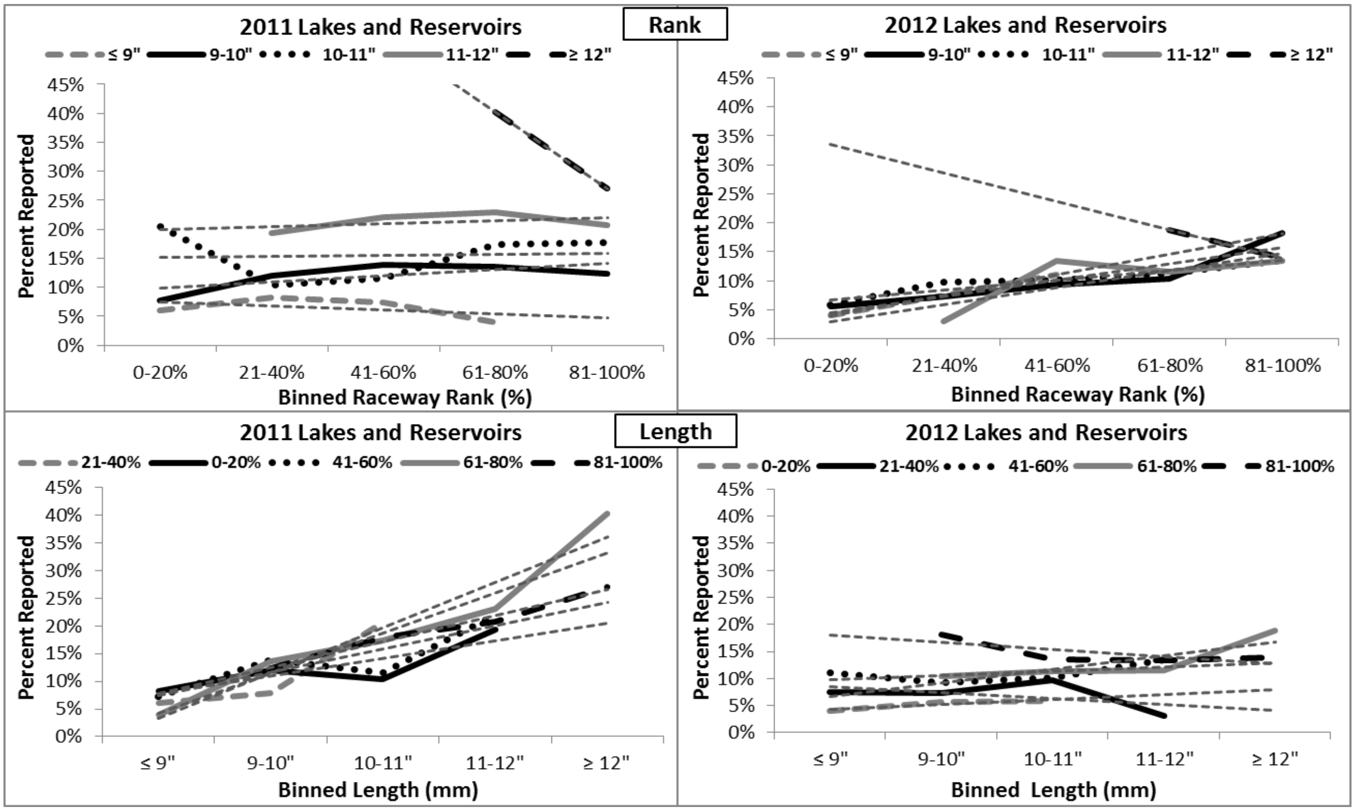

Figure 8. Percent of tags that were reported (unexpanded for catch or harvest) vs. binned percent raceway rank and binned raceway length for fish released into lakes and reservoirs in 2011 and 2012.

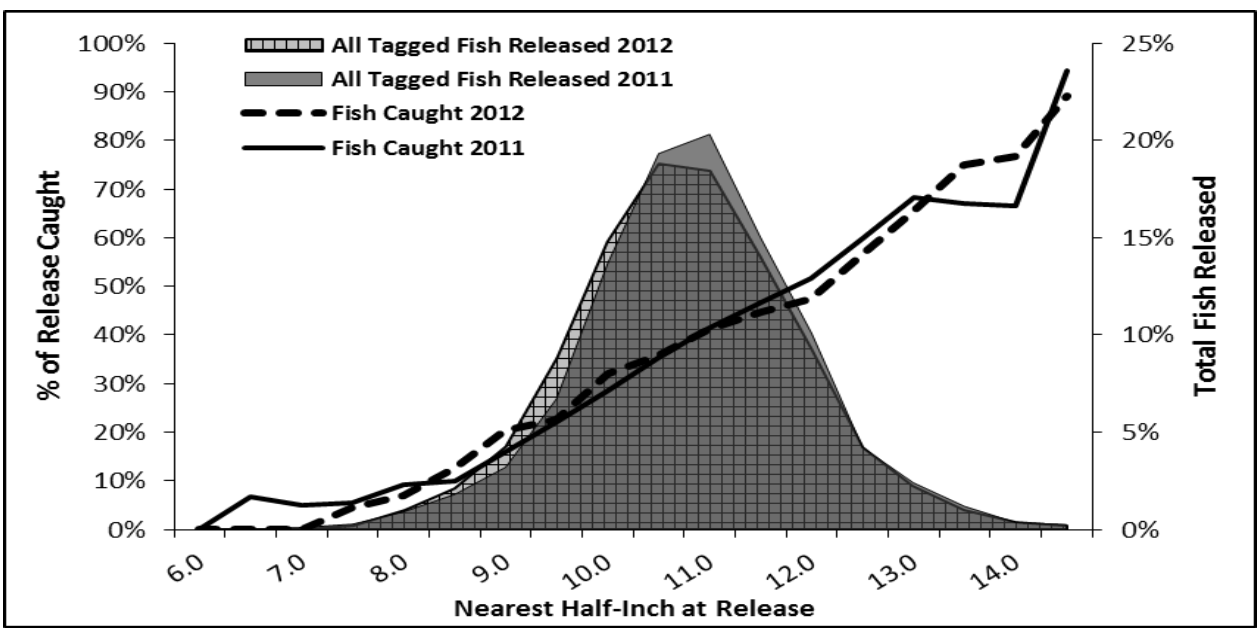

Figure 9. Mean percent of tags that were caught vs. length at tagging of all hatchery catchable trout released in 2011 and 2012. The shaded gray areas show the number of tagged fish released each year and is plotted on the secondary Y axis.

ANNUAL PERFORMANCE REPORT
SUBPROJECT #2: RELATIVE PERFORMANCE OF TRIPLOID KOKANEE SALMON IN IDAHO LAKES AND RESERVOIRS

State of: Idaho

Grant No.: F-73-R-36 Fishery Research

Project No.: 4

Title: Hatchery Trout Evaluations

Subproject #1: Relative Performance of Triploid Kokanee Salmon in Idaho Lakes and Reservoirs

Contract Period: July 1, 2013 to June 30, 2014

ABSTRACT

Kokanee Salmon *Oncorhynchus nerka* are an important recreational species in reservoirs and lakes across the western United States. Harvest rates of Kokanee Salmon are heavily influenced by growth rates, population density, and fish size. Additionally, Kokanee Salmon mature early and typically spawn and die at age-3 or age-4. Due to slow growth rates, short lifespan, and angler preference for larger fish, Kokanee Salmon are often only exploited for a short period of time during their last year. In Idaho, using triploid salmonids has become increasingly common in hatchery-supported freshwater fisheries. Benefits of stocking triploid salmonids may include increased longevity and survival, genetic protection of wild stocks, as well as increased growth. However, the benefits and relative performance of diploid and triploid salmonids is often species-specific. In some cases, drawbacks of stocking triploid salmonids may include higher mortality and reduced growth during early life-history stages. Previous research on the performance of triploid Kokanee Salmon relative to diploid conspecifics is limited to only a few examples and questions remain about sterile Kokanee Salmon performance. The objectives of this study are to: (1) describe Kokanee Salmon populations before and after switching to triploid-only stocking relative to control lakes, (2) increase catch-per-unit-effort (CPUE) of 250 mm (or greater) Kokanee Salmon by 25%, and (3) increase the proportion of “quality” sized Kokanee Salmon (i.e., fish >300 mm in length) by 25% after switching to triploid-only Kokanee Salmon stocking. Four water bodies were selected to be used in our evaluation, two treatments (Mirror Lake and Montpelier Reservoir) and two controls (Lower Twin Lake and Devils Creek Reservoir). In 2013, we completed the second season of initial sampling to describe the existing populations of diploid Kokanee Salmon. Devils Creek Reservoir had the largest Kokanee Salmon, followed by Twin Lake, Montpelier, and Mirror Lake. CPUE was highest in in Devils Creek Reservoir, followed by Mirror Lake, Upper Twin Lake, and Montpelier Reservoir. Length at age and age at maturity were highly variable across water bodies. Stocking at the two treatment lakes will continue to consist of only pressure-treated triploid Kokanee Salmon, while control lakes will continue with normal diploid stocking consistent with previous stocking. Consistent year-to-year sampling will continue annually at least through 2017, when the first group of triploid Kokanee Salmon will have reached age-four, to document any increase in longevity or mean size in the population.

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INTRODUCTION

Kokanee Salmon *Oncorhynchus nerka* are an important recreational species in reservoirs and lakes across the western United States and Canada (Rieman and Myers 1992). Kokanee Salmon may support high yield fisheries or provide a forage base for large piscivores (Wydoski and Bennett 1981). While Kokanee Salmon are important to the harvest-oriented anglers and for providing trophy fisheries, managing for healthy Kokanee Salmon populations is often problematic (Beattie and Clancey 1991). Harvest rates of Kokanee Salmon are heavily influenced by growth rates, population density, and fish size. Since the majority of Kokanee Salmon populations in Idaho are found in oligotrophic lakes or reservoirs, growth rates are low, especially when population densities exceed 50 fish/ha (Rieman and Maiolie 1995). Additionally, Kokanee Salmon mature early and typically spawn and die at age-3 or age-4 (Johnston et al. 1993). Due to slow growth rates, short life span, and angler's preference for larger fish, Kokanee Salmon are often only exploited for a short period of time during their last year.

In Idaho, hatchery-reared diploid (2N) Kokanee Salmon are stocked to supplement wild populations and to provide put/grow/take fisheries. Using triploid (3N) salmonids has become increasingly common in hatchery-supported freshwater fisheries. Triploid salmonids are functionally sterile, and the common assertion is that sterility provides a fisheries or aquaculture benefit (Teuscher et al. 2003). Benefits of stocking triploid salmonids may include increased longevity and survival (Ihssen et al. 1990), genetic protection of wild stocks (Rohrer and Thorgaard 1986), as well as increased growth (Habicht et al. 1994; Sheehan et al. 1999). However, the benefits and relative performance of diploid and triploid salmonids is often species-specific. In some cases, drawbacks of stocking triploid salmonids may include higher mortality and reduced growth during early life-history stages (Myers and Hershberger 1991). For example, triploid Rainbow Trout often survive at lower rates in some reservoirs, even when stocked at “catchable” sizes (Koenig and Meyer 2011), or when mixed-sex fry are stocked in alpine lakes (Koenig et al. 2011). Additionally, past pressure treatment trials indicated survival to eye-up for 3N Kokanee Salmon egg lots are at least 10% lower than diploid control groups (Koenig 2011), requiring more eggs be collected to meet stocking requests.

Previous research on the performance of triploid Kokanee Salmon relative to diploid conspecifics is limited to only a few examples. Parkinson and Tsumura (1988) evaluated hormone-sterilized Kokanee Salmon in three lakes, and found that sterilized fish survived at only 10% the rate of control fish up to maturity. Despite low early survival, sterilized Kokanee Salmon lived beyond the normal life span, but no size advantage was ever achieved.

Johnston et al. (1993) performed a similar evaluation (in one lake) also using hormone-sterilized Kokanee Salmon. Their results showed very low catch of treated Kokanee Salmon at age-1 and –2, but catch increased relative to controls after age-3. Despite longevity to age-7, the total catch of treated Kokanee Salmon was always lower than controls, even over the long term. Total catch of treated Kokanee Salmon was about 30-75% of controls over a seven-year period, while most control fish were returned within four years. As with Parkinson and Tsumura (1988), sterile Kokanee Salmon did not show any growth advantage.

In 2005, the Idaho Department of Fish and Game (IDFG) began a multiyear study to examine relative growth and survival of triploid and diploid Kokanee Salmon across five lakes and reservoirs. Diploid and triploid Kokanee Salmon were stocked together in each reservoir in similar numbers during spring 2005 and sampled from 2007-2009. Results from the 2007 sample (which recaptured the most fish) indicated that 73% of recaptured marked fish were diploid, and that there was no size difference between diploid and triploid groups. This study suffered from low triploid-induction rates (79%) and very few recaptured marked fish. As a result of these limitations, significant uncertainty about the relative performance of diploid and triploid Kokanee Salmon remains. More recently, Canadian biologists have been experimenting with triploid Kokanee Salmon in sport fish applications. Initial studies in several lakes stocked only with triploid Kokanee Salmon indicate triploid Kokanee Salmon do not produce the same quality fisheries as lakes stocked exclusively with diploid fish (Mike Ramsay, BC Ministry of Natural Resource Operations, personal communication). Ramsay has concluded that triploid Kokanee Salmon experience much higher mortality at younger age-classes and lower growth rates, preventing 3N Kokanee Salmon from ever achieving the intended goal of larger, older fish.

The studies mentioned above have some serious limitations. Each study was only performed in 1-3 lakes, with no definitive marks to differentiate diploid and triploid fish, making comparisons of catch between groups difficult. Parkinson and Tsumura (1988), Johnston et al. (1993), and Koenig and Meyer (2011) all compared treatment and control fish stocked in the same lakes, where competition might have been a factor. The data from Mike Ramsay do not include any information describing the fishery before switching to triploid only. Despite the growing body of evidence against using triploid Kokanee Salmon for managing sport fisheries, questions remain about sterile Kokanee Salmon performance from these studies.

While triploid Kokanee Salmon would be a poor alternative to increase natural production, their greater longevity could be beneficial for extending recreational fishing opportunities over the long term. Enhanced longevity may provide additional sportfishing opportunity in subsequent years after semelparous diploids would have already perished. Greater longevity could result in larger ultimate size from a longer growth period, and possibly higher yield, since Kokanee Salmon are known to be increasingly susceptible to angling as length increases (Rieman and Maiolie 1995). We are interested in whether the benefits of stocking triploid Kokanee Salmon in put/grow/take fisheries would outweigh the detriments of lower egg eye-up rates and potentially poorer initial survival (Parkinson and Tsumura 1988). The goal of this study is to compare relative performance of Kokanee Salmon fisheries before and after converting to triploid Kokanee Salmon stocking. More specifically, the objective of this study is to enhance the longevity of Kokanee Salmon through sterilization by at least one year and thereby increase harvest rates by at least 25%.

OBJECTIVES

1. Describe Kokanee Salmon populations before and after switching to triploid-only stocking relative to control lakes.

2. Increase CPUE of 250 mm (or greater) Kokanee Salmon by 25%.

3. Increase the proportion of “quality” sized Kokanee Salmon (PSD; Kokanee Salmon >300 mm) by 25% after switching to triploid-only Kokanee Salmon stocking.

METHODS

Study Sites

Since this study aims to compare fisheries after converting to triploid-only stocking, study sites were chosen from those currently stocked with Kokanee Salmon. Few locations were suitable for research purposes, as we did not want to risk collapsing any popular sport fisheries, and sites had to be of manageable size for cost and sampling efficiency. Additionally, naturally reproducing populations of Kokanee Salmon may confound results and make interpreting treatment effects difficult. Based on these selection criteria, Mirror Lake and Montpelier Reservoir were chosen as treatment waters, while Lower Twin Lake and Devils Creek Reservoir were chosen as control waters (Table 5).

The existing populations of normally stocked diploid Kokanee Salmon in Mirror Lake and Montpelier Reservoir will serve as the baseline from which to compare the treatment of switching to stocking only triploid Kokanee Salmon. One season (2012) of initial sampling will describe the existing populations (length distributions, age classes, growth rates) of diploid Kokanee Salmon at all four water bodies. After this initial sampling, stocking at the treatment lakes will switch to stocking only triploid Kokanee Salmon, while control lakes will continue with normal diploid stocking consistent with previous years. Since a particular cohort of Kokanee Salmon will not impact the fishery until at least a year after stocking, a second season of monitoring in 2013 will serve as an additional year of baseline data for the existing populations, both in treatment and control waters.

Collecting Eggs/Spawning

The first triploid treatment and diploid control groups were spawned in September of 2012 during normally scheduled weir operations on the Deadwood River. Normal production Kokanee Salmon were used for the 2N control groups. Triploid production lots were made using pressure-treatment on site. The recipe used was a treatment of 9500 psi at 350 Celsius Minutes After Fertilization (CMAF) for five minutes. Additional treatment and control groups will be spawned in identical fashion from 2013 through 2016 (Table 6).

Hatchery Rearing

Fertilized eggs were shipped by aircraft to Cabinet Gorge Hatchery where they were reared until the eyed egg stage. Diploid and triploid test groups received year-specific otolith thermal marks to distinguish them from existing diploid Kokanee Salmon, and from subsequent year classes to ensure correct age identification. This mark will be confirmed prior to stocking. Stocking lots for Devils Creek and Montpelier reservoirs were transferred to Mackay Hatchery to complete rearing, while Cabinet Gorge Hatchery reared Kokanee Salmon for Mirror and Lower Twin lakes.

Prior to stocking triploid groups, 100 blood samples and 10 control (diploid) samples were collected to check triploid-induction rates. Blood samples were collected by severing the caudal peduncle of each fish and immersing it in a tube filled with Alsever's solution. Samples were shipped to Dr. Jeff Hinshaw at North Carolina State University for analysis by flow cytometry. At the time of stocking, mean size of the diploid and triploid groups was recorded. Total length (mm) and weight (g) were collected from 100 individual fish in each group.

Sampling

Kokanee Salmon sampling began in 2012 and will continue annually through 2017 (Table 6), when the first group of triploid Kokanee Salmon will have reached age-4. Net locations for sampling fish were initially randomly assigned, and will be repeated in each following year. The limnetic zone of each lake was divided into numbered squares and a random number generator was used to select three squares that will serve as monitoring locations where one net will be placed. Net locations were recorded with GPS and will be used for sampling each year. One net was fished at each location for a total of three net-nights per lake. This will be repeated in subsequent years to help reduce random variation in catch-per-unit-effort between years. Sampling effort may be increased if catch rates are low and more Kokanee Salmon samples are needed to adequately characterize the populations.

Kokanee Salmon will be sampled each year during the period ranging from mid-June to mid-July, after waters have begun to stratify, around the timing of the new moon phase. Fish will be collected using experimental net curtains suspended at the depth of the thermocline. Experimental net curtains measure 55 m long by 6 m deep. Two of the three nets were “small” mesh and were composed of panels ranging from 19 to 64 mm bar mesh monofilament, while the third net was “medium” mesh composed of panels ranging from 64 to 152 mm bar mesh monofilament. Panels were randomly positioned on nets during manufacturing.

All Kokanee Salmon captured will be measured for total length to the nearest millimeter and a sample from each size-class weighed to the nearest gram. Otoliths will be collected to identify thermal marks and estimate fish age.

Data Analysis

We assume standing Kokanee Salmon stocks before and after switching to triploid-only stocking can be described in terms of fish size distribution and catch rates. These could include catch-per-unit-effort (CPUE), biomass-per-unit-effort (BPUE), incremental growth rates, and proportional stocking density (PSD). Mean catch rate (CPUE) at each lake will be calculated as the average catch rate (fish/hour) across the total number of nets. Proportional stock density (using 200 mm as stock length and 300 mm as quality length), size-at-age, and mean total length will characterize stock structure in each lake. Sectioned otolith samples will be examined to determine fish age, and thermal marks will be used to describe the age structure of the populations in each lake. Growth rates across ploidy level will be compared using incremental growth.

RESULTS

Baseline samples of diploid Kokanee Salmon were collected from all four water bodies in 2012 and again in 2013. Sampling effort, CPUE, as well as age structure of sample fish for both years, are outlined in Table 7 and length frequencies are graphed in Figure 10.

DISCUSSION

Length at age was highly variable across water bodies with Devils’ Creek showing the highest growth rates (largest length at age) and Mirror Lake showing the lowest growth (smallest length at age). Average length at age-2 varied by 262 mm between the two water bodies in 2012 (467 mm vs. 205 mm). Lower Twin Lake also showed high growth while Montpelier Reservoir showed more moderate growth (Table 7). Additionally, the larger, faster growing fish of Devil’s Creek Reservoir and Lower Twin Lake appear to mature and spawn at an earlier age, as very few fish over the age of two were sampled, while there were many age-3 Kokanee Salmon in the slow growing Mirror Lake population. Older age at maturity associated with slower growth rates is well established in the literature (Grover 2005).

CPUE remained somewhat consistent from 2011 to 2012 with Montpelier Reservoir showing the lowest CPUE and Mirror Lake remaining high. The largest change in CPUE occurred at Lower Twin Lake where CPUE dropped from 3.00 to 1.82 from 2011 to 2012. It will be interesting to see how CPUE numbers trend over time across water bodies and this study continues.

Future reports will contain more detailed information in regards to this study as the treatment and control groups mature and become more apparent in the overall populations.

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Table 5. Current list of waters and stocking numbers for early Kokanee Salmon. Selected study sites for evaluating switching to triploid-only stocking (treatment) are shown in bold font.

Region	Lake Name	Hatchery	Number	Comments
01	Hauser L.	Cabinet Gorge	0	Stocking discontinued
01	Hayden L.	Cabinet Gorge	100,000	Fishery risk?
01	Lower Twin L.	Cabinet Gorge	60,000	**Study site - CONTROL**
01	Mirron L.	Cabinet Gorge	5,000	**Study site - TREATMENT**
01	Spirit L.	Cabinet Gorge	0	Stocking discontinued
3B	Arrowrock Res.	Mackay	50,000	Too big, fishery risk
3B	Lucky Peak Res.	Mackay	200,000	Too big, fishery risk
3M	Cascade Res	Mackay	250,000	Too big, natural production
3M	Payette L.	Mackay	460,000	Too big, natural production
3M	Warm L.	Cabinet Gorge	50,000	Natural production, 3N already
04	Anderson Ranch Res.	Mackay	0	Stocking discontinued
05	Devils Creek Res.	Mackay	7,000	**Study site - CONTROL**
05	Montpelier Res.	Mackay	6,000	**Study site - TREATMENT**
06	Island Park Res.	Mackay	250,000	Too big, fishery risk
06	Ririe Res.	Mackay	210,000	Too big, fishery risk

Table 6. Study timeline for stocking and monitoring diploid (2N) and triploid (3N) Kokanee Salmon in two control and two treatment lakes.

Treatment	2012	2013	2014	2015	2016	2017
Control	**Stock 2N** →	→	→	→	→	→
2N-no mark	ages 0, 1, 2	0, 1, 2	0, 1, 2	0, 1, 2	0, 1, 2	0, 1, 2
Treatment	**Stock 2N** →	**Stock 3N only** →	→	→	→	→
2N-no mark	ages 0, 1, 2	1, 2	2	none	none	none
3N-marked		0	0, 1	0, 1, 2	0, 1, 2, 3	0, 1, 2, 3, 4

Table 7. Net-hours, CPUE, and age distribution of diploid (2N) and triploid (3N) Kokanee Salmon in two control and two treatment lakes for sample years 2012 and 2013.

Sample Year	Water Body	Treatment	Net-Hours	CPUE	Mean Length-At-Age (mm)			
					Age 0	Age 1	Age 2	Age 3
2012	Montpelier Res.	2N	105.8	1.63	109	203	277	337
	Devils Creek Res.	3N	49.1	3.60	121	317	459	NA
	Mirror Lake	2N	46.5	4.10	100	160	205	246
	Lower Twin Lake	3N	89.8	3.00	106	293	389	NA
2013	Montpelier Res.	2N	54.5	1.27	112	220	274	NA
	Devils Creek Res.	3N	47.0	4.68	115	317	467	500
	Mirror Lake	2N	45.5	4.37	104	159	205	235
	Lower Twin Lake	3N	45.0	1.82	104	289	393	NA

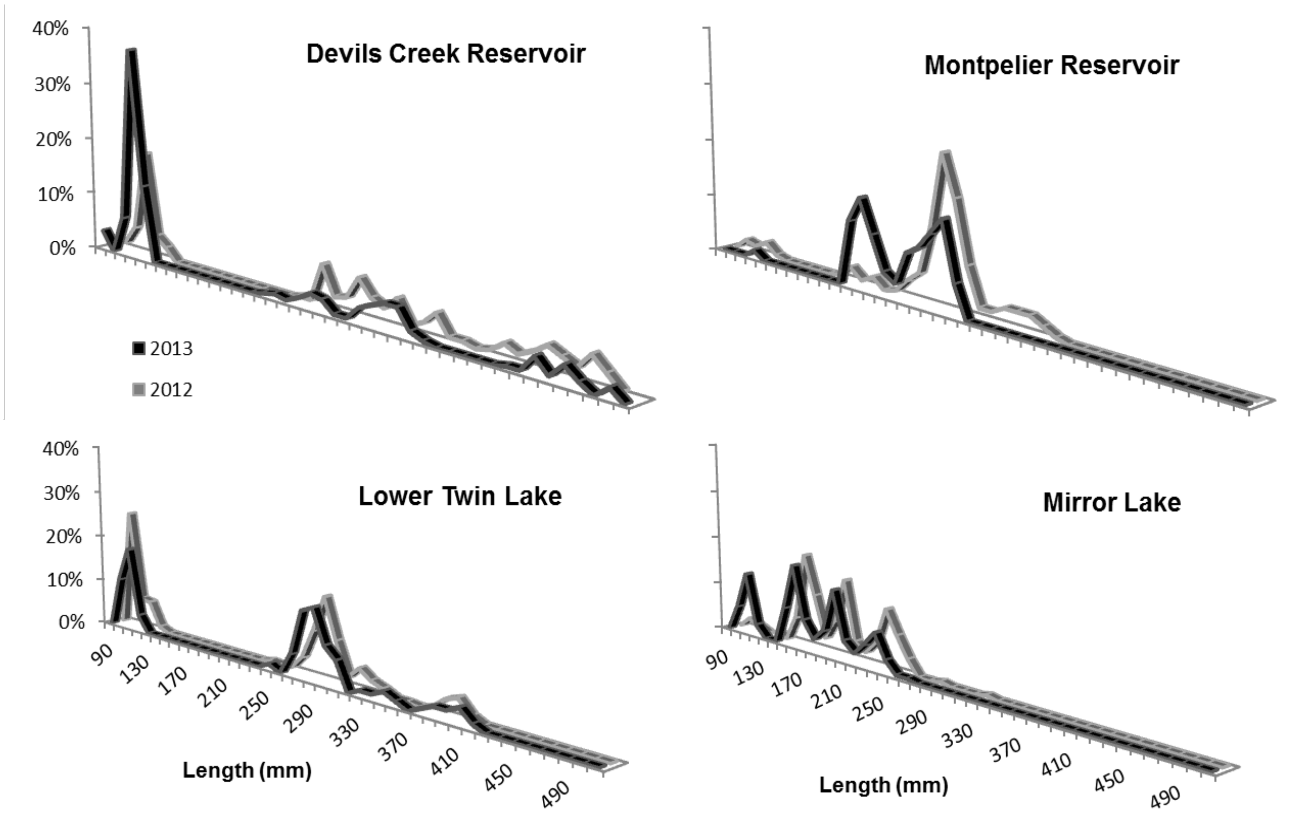

Figure 10. Length distribution (by percent) of Kokanee Salmon across the four different study water bodies. These distributions represent “baseline” samples taken in the summer of 2012 and 2013.

APPENDIX

Appendix A. Total nonreward tags released by water body, hatchery, treatment and date in 2011. Harvest and Total Catch are shown as of October 30, 2013 with associated 90% confidence intervals (C.I.) and are reported for both the first and second year at large.

Region	Tag Coordiantor	Water Body	Hatchery	Tagging Date	Treatment	Tags Released	0-365 Days Post Release				366-720 Days Post Release			
							Harvest		Total Catch		Harvest		Total Catch	
							Estimate	90% C.I.	Estimate	90% C.I.	Estimate	90% C.I.	Estimate	90% C.I.
1	Ryan Hardy	Hayden Lake	Sandpoint	6/16/2011	Regional evaluation	100	9.6%	8.5%	19.2%	12.1%	7.4%	10.8%	7.4%	10.8%
	Koenig Martin	Crystal Lake	Sandpoint	5/3/2011	Normal production	117	6.6%	6.5%	8.2%	7.3%	0.0%		0.0%	
				5/18/2011		117	1.6%	3.2%	1.6%	3.2%	0.0%		0.0%	
		Fernan Lake	Mullan	6/2/2011	Normal production	197	2.9%	3.4%	5.8%	4.8%	0.0%		0.0%	
				6/15/2011		198	6.8%	5.2%	8.7%	5.9%	0.0%		0.0%	
		Hauser Lake	Sandpoint	5/3/2011	Normal production	192	7.0%	5.3%	8.0%	5.7%	0.0%		0.0%	
				5/18/2011		193	6.0%	4.9%	7.0%	5.3%	0.0%		0.0%	
	Liter Mark	Bull Moose Lake	Sandpoint	5/17/2011	Regional evaluation	99	25.2%	13.9%	31.0%	15.5%	2.5%	6.2%	2.5%	6.2%
		Freeman Lake	Sandpoint	4/18/2011	Regional evaluation	100	11.5%	9.3%	13.4%	10.1%	0.0%		0.0%	
				5/10/2011		99	15.5%	10.9%	15.5%	10.9%	0.0%		0.0%	
		Jewel Lake	Clark Fork	4/18/2011	Regional evaluation	99	48.4%	19.4%	54.2%	20.6%	0.0%		0.0%	
			Sandpoint	5/10/2011	Regional evaluation	98	58.7%	21.6%	64.6%	22.6%	0.0%		0.0%	
		Robinson Lake	Sandpoint	4/26/2011	Regional evaluation	100	26.8%	14.3%	28.8%	14.8%	0.0%		0.0%	
				5/17/2011		100	24.9%	13.8%	34.5%	16.3%	0.0%		0.0%	
		Smith Lake	Sandpoint	4/26/2011	Regional evaluation	100	28.8%	14.8%	28.8%	14.8%	0.0%		0.0%	
				5/17/2011	Regional evaluation	100	36.4%	16.7%	40.3%	17.6%	0.0%		0.0%	
2	Bowersox Brett	Palouse River Dredge Pond	Clearwater	5/17/2011	Regional evaluation	50	15.3%	14.9%	15.3%	14.9%	0.0%		0.0%	
	Koenig Martin	Deer Creek Reservoir	Clearwater	5/10/2011	Normal production	397	10.1%	4.8%	10.1%	4.8%	1.2%	2.2%	1.9%	2.8%
				10/19/2011		400	7.2%	3.9%	8.6%	4.3%	0.0%		0.0%	
		Dworshak Reservoir	Nampa	6/13/2011	Normal production	400	8.1%	4.2%	9.6%	4.6%	1.2%	2.2%	1.9%	2.8%
		Elk Creek Reservoir	Clearwater	6/14/2011	Normal production	400	45.5%	12.6%	59.0%	15.2%	0.6%	1.5%	0.6%	1.5%
				10/26/2011		397	13.5%	5.6%	22.2%	7.7%	0.0%		0.0%	
		Hordeman Pond	Clearwater	5/17/2011	Regional evaluation	100	7.7%	7.6%	7.7%	7.6%	0.0%		0.0%	
				4/26/2011	Regional evaluation	74	62.2%	24.4%	64.8%	24.9%	0.0%		0.0%	
		Mann Lake	Hagerman	4/7/2011	Normal production	400	23.5%	7.9%	39.3%	11.3%	0.0%		0.0%	
				5/10/2011	High density	200	18.2%	8.7%	34.5%	12.6%	0.0%		0.0%	
					Low density	199	28.9%	11.4%	42.4%	14.3%	0.0%		0.0%	
				10/12/2011	Clearsprings 2N	100	1.9%	3.8%	3.8%	5.4%	0.0%		0.0%	
					Hayspur 3N	99	0.0%		1.9%	3.8%	0.0%		0.0%	
		Moose Creek Reservoir	Hagerman	4/25/2011	High density	200	30.7%	11.8%	39.3%	13.6%	0.0%		0.0%	
					Low density	198	41.6%	14.2%	49.4%	15.7%	1.3%	3.1%	1.3%	3.1%
				10/12/2011	Normal production	396	16.9%	6.5%	23.2%	7.9%	0.0%		0.0%	
		Robinson Pond	Clearwater	4/21/2011	Normal production	150	56.2%	18.4%	60.1%	19.2%	0.0%		0.0%	
				9/27/2011		125	30.7%	14.0%	56.8%	19.6%	0.0%		0.0%	
		Snake River Levee Pond	Clearwater	3/17/2011	Exploitation	100	46.0%	18.9%	55.6%	20.8%	0.0%		0.0%	
				4/11/2011	Exploitation	99	38.7%	17.3%	60.0%	21.7%	0.0%		0.0%	
		Spring Valley Reservoir	Hagerman	5/10/2011	Normal production	400	39.3%	11.3%	54.2%	14.3%	0.6%	1.5%	0.6%	1.5%
				10/12/2011	High density	200	54.6%	16.7%	55.6%	16.9%	1.2%	3.1%	1.2%	3.1%
					Low density	200	53.7%	16.5%	58.5%	17.5%	2.5%	4.4%	2.5%	4.4%
		Winchester Lake	American Falls	4/26/2011	High density	200	42.2%	14.2%	56.6%	17.1%	0.0%		0.0%	
					Low density	200	53.7%	16.5%	65.2%	18.7%	1.2%	3.1%	1.2%	3.1%
					Medium density	200	42.2%	14.2%	57.5%	17.3%	0.0%		0.0%	
			Hagerman	4/26/2011	High density	200	32.6%	12.2%	40.3%	13.8%	1.2%	3.1%	2.5%	4.4%
					Low density	200	35.5%	12.8%	52.7%	16.3%	1.2%	3.1%	1.2%	3.1%
				10/12/2011	Normal production	396	24.7%	8.2%	32.0%	9.8%	0.6%	1.6%	1.3%	2.2%
			Nampa	4/26/2011	High density	200	33.6%	12.4%	43.1%	14.4%	0.0%		0.0%	
					Low density	200	34.5%	12.6%	43.1%	14.4%	0.0%		0.0%	
					Medium density	195	19.7%	9.2%	30.5%	11.8%	1.3%	3.2%	1.3%	3.2%

Region	Tag Coordiantor	Water Body	Hatchery	Tagging Date	Treatment	Tags Released	0-365 Days Post Release: Harvest Estimate	Harvest 90% C.I.	Total Catch Estimate	Total Catch 90% C.I.	366-720 Days Post Release: Harvest Estimate	Harvest 90% C.I.	Total Catch Estimate	Total Catch 90% C.I.
3B	Butts Art	Boise River	Nampa	1/20/2011	Regional evaluation	160	1.2%	2.4%	1.2%	2.4%	0.0%		0.0%	
	Koenig Martin	Boise River	Nampa	7/26/2011	Normal production	40	24.0%	20.4%	57.5%	30.0%	6.2%	15.2%	6.2%	15.2%
				10/18/2011		40	71.9%	32.7%	105.5%	37.2%	0.0%		0.0%	
				7/26/2011	Normal production	40	24.0%	20.4%	71.9%	32.7%	0.0%		0.0%	
				10/18/2011		40	57.5%	30.0%	100.7%	36.7%	0.0%		0.0%	
				7/26/2011	Normal production	40	52.7%	29.0%	81.5%	34.2%	0.0%		0.0%	
				10/18/2011		40	4.8%	9.4%	24.0%	20.4%	0.0%		0.0%	
				7/26/2011	Normal production	20	28.8%	30.8%	76.7%	44.5%	0.0%		0.0%	
				10/18/2011		20	19.2%	25.7%	38.3%	34.8%	0.0%		0.0%	
				7/26/2011	Normal production	20	19.2%	25.7%	28.8%	30.8%	0.0%		0.0%	
				10/18/2011		20	19.2%	25.7%	38.3%	34.8%	0.0%		0.0%	
				7/26/2011	Normal production	40	24.0%	20.4%	52.7%	29.0%	0.0%		0.0%	
				10/18/2011		40	47.9%	27.8%	81.5%	34.2%	0.0%		0.0%	
				7/26/2011	Normal production	20	38.3%	34.8%	57.5%	40.7%	0.0%		0.0%	
				10/18/2011		20	9.6%	18.6%	47.9%	38.0%	0.0%		0.0%	
				7/26/2011	Normal production	20	19.2%	25.7%	57.5%	40.7%	0.0%		0.0%	
				10/18/2011		20	28.8%	30.8%	86.3%	45.9%	0.0%		0.0%	
				7/26/2011	Normal production	40	4.8%	9.4%	52.7%	29.0%	0.0%		0.0%	
				10/18/2011		40	4.8%	9.4%	67.1%	31.9%	0.0%		0.0%	
				7/26/2011	Normal production	40	33.6%	23.8%	47.9%	27.8%	0.0%		0.0%	
				10/18/2011		40	14.4%	16.1%	33.6%	23.8%	0.0%		0.0%	
		Caldwell Rotary Pond	Nampa	4/6/2011	Normal production	125	61.4%	20.4%	78.2%	23.5%	0.0%		0.0%	
				10/18/2011		125	44.5%	17.1%	59.8%	20.1%	0.0%		0.0%	
		Eagle Island Park Pond	Nampa	4/6/2011	Normal production	125	32.2%	14.4%	39.9%	16.1%	2.0%	4.9%	2.0%	4.9%
				10/19/2011		125	36.8%	15.4%	55.2%	19.3%	0.0%		0.0%	
		Manns Creek Reservoir	Nampa	4/20/2011	High density	197	3.9%	3.9%	5.8%	4.8%	0.0%		0.0%	
					Low density	199	9.6%	6.2%	10.6%	6.5%	0.0%		0.0%	
					Medium density	198	2.9%	3.3%	2.9%	3.3%	0.0%		0.0%	
					Normal production	199	1.9%	2.7%	4.8%	4.3%	0.0%		0.0%	
		McDevitt Pond	Nampa	4/6/2011	Normal production	150	38.3%	14.8%	65.2%	20.1%	0.0%		0.0%	
				10/19/2011	Normal production	125	26.1%	12.9%	35.3%	15.1%	0.0%		0.0%	
		Mountain Home Reservoir	Hagerman	10/12/2011	Clearsprings 2N	100	9.6%	8.5%	17.3%	11.4%	5.0%	8.7%	5.0%	8.7%
					Hayspur 3N	100	19.2%	12.1%	19.2%	12.1%	2.5%	6.1%	2.5%	6.1%
		Sage Hen Reservoir	Nampa	6/7/2011	High density	200	26.8%	10.9%	35.5%	12.8%	6.2%	7.2%	6.2%	7.2%
					Low density	200	38.3%	13.4%	52.7%	16.3%	2.5%	4.4%	2.5%	4.4%
					Medium density	200	25.9%	10.7%	44.1%	14.6%	6.2%	7.2%	6.2%	7.2%
					Normal production	200	28.8%	11.3%	43.1%	14.4%	2.5%	4.4%	3.7%	5.4%
		Wilson Springs Pond	Nampa	2/3/2011	Normal production	50	92.0%	33.1%	103.5%	34.5%	0.0%		0.0%	
				2/10/2011		50	84.4%	32.0%	95.9%	33.6%	0.0%		0.0%	
				2/17/2011		50	69.0%	29.6%	92.0%	33.1%	0.0%		0.0%	
				2/24/2011		50	99.7%	34.1%	118.9%	36.1%	0.0%		0.0%	
				4/6/2011		50	46.0%	24.9%	61.4%	28.1%	0.0%		0.0%	
				4/14/2011		50	84.4%	32.0%	111.2%	35.4%	0.0%		0.0%	
				4/22/2011		50	53.7%	26.6%	53.7%	26.6%	0.0%		0.0%	
				4/28/2011		50	57.5%	27.4%	61.4%	28.1%	0.0%		0.0%	
				7/7/2011	High density	50	53.7%	26.6%	88.2%	32.6%	0.0%		0.0%	
				7/14/2011	Normal production	49	23.5%	18.4%	70.4%	30.0%	0.0%		0.0%	
				8/4/2011		50	42.2%	23.9%	53.7%	26.6%	0.0%		0.0%	
				8/10/2011		50	46.0%	24.9%	72.9%	30.2%	0.0%		0.0%	
				10/7/2011		50	38.3%	22.9%	42.2%	23.9%	0.0%		0.0%	
				10/15/2011		50	49.9%	25.7%	69.0%	29.6%	0.0%		0.0%	
				10/19/2011		50	30.7%	20.7%	49.9%	25.7%	0.0%		0.0%	
				10/27/2011		50	38.3%	22.9%	69.0%	29.6%	0.0%		0.0%	
3M	Koenig Martin	Cascade Reservoir	Hagerman	10/31/2011	Clearsprings 2N	200	1.9%	2.7%	2.9%	3.3%	2.5%	4.4%	2.5%	4.4%
					Hayspur 3N	200	1.0%	1.9%	1.9%	2.7%	3.7%	5.4%	3.7%	5.4%
		Horsethief Reservoir	American Falls	5/17/2011	High density	200	37.4%	13.2%	50.8%	16.0%	2.5%	4.4%	3.7%	5.4%
					Low density	200	34.5%	12.6%	46.0%	15.0%	3.7%	5.4%	3.7%	5.4%
					Medium density	200	39.3%	13.6%	56.6%	17.1%	3.7%	5.4%	6.2%	7.2%
			Hagerman	5/17/2011	High density	200	24.0%	10.2%	31.6%	12.0%	6.2%	7.2%	6.2%	7.2%
					Low density	199	37.6%	13.3%	46.2%	15.1%	3.7%	5.5%	3.7%	5.5%
				9/16/2011	Normal production	400	28.3%	9.0%	33.6%	10.1%	1.2%	2.2%	1.9%	2.7%
			Nampa	5/17/2011	High density	200	23.0%	10.0%	31.6%	12.0%	5.0%	6.4%	5.0%	6.4%
					Low density	200	29.7%	11.5%	35.5%	12.8%	3.7%	5.4%	5.0%	6.4%
					Medium density	200	33.6%	12.4%	41.2%	14.0%	5.0%	6.4%	5.0%	6.4%
		Lost Valley Reservoir	Hagerman	6/6/2011	High density	199	24.1%	10.2%	31.8%	12.0%	2.4%	4.4%	2.4%	4.4%
					Low density	200	47.0%	15.2%	49.9%	15.8%	1.2%	3.1%	1.2%	3.1%
		Rowlands Pond	McCall	5/20/2011	Normal production	125	23.0%	12.0%	41.4%	16.5%	0.0%		0.0%	
				7/8/2011		122	61.3%	20.6%	78.6%	23.7%	0.0%		0.0%	
		Warm Lake	Nampa	6/28/2011	High density	200	30.7%	11.8%	39.3%	13.6%	0.0%		0.0%	
					Low density	200	40.3%	13.8%	47.9%	15.4%	0.0%		1.7%	4.2%
					Medium density	200	40.3%	13.8%	49.9%	15.8%	1.2%	3.1%	1.2%	3.1%
					Normal production	200	18.2%	8.7%	26.8%	10.9%	1.2%	3.1%	1.2%	3.1%

Region	Tag Coordiantor	Water Body	Hatchery	Tagging Date	Treatment	Tags Released	0-365 Days Post Release				366-720 Days Post Release			
							Harvest		Total Catch		Harvest		Total Catch	
							Estimate	90% C.I.	Estimate	90% C.I.	Estimate	90% C.I.	Estimate	90% C.I.
4	Koenig Martin	Anderson Ranch Reservoir	American Falls	5/4/2011	High density	200	9.6%	6.2%	14.4%	7.7%	0.0%		0.0%	
					Low density	200	12.5%	7.1%	17.3%	8.5%	3.7%	5.4%	3.7%	5.4%
					Medium density	200	8.6%	5.8%	17.3%	8.5%	1.2%	3.1%	1.2%	3.1%
			Hagerman	5/4/2011	High density	198	7.7%	5.5%	11.6%	6.9%	0.0%		1.3%	3.1%
					Low density	200	9.6%	6.2%	12.5%	7.1%	2.5%	4.4%	2.5%	4.4%
			Nampa	5/4/2011	High density	200	3.8%	3.8%	4.8%	4.3%	0.0%		0.0%	
					Low density	200	7.7%	5.5%	12.5%	7.1%	1.2%	3.1%	1.2%	3.1%
					Medium density	200	6.7%	5.1%	7.7%	5.5%	1.2%	3.1%	1.2%	3.1%
		Connor Pond	Hagerman	4/19/2011	Normal production	148	0.0%		0.0%		0.0%		0.0%	
		Dierke's Lake	Hagerman	10/11/2011	Clearsprings 2N	95	12.1%	9.8%	40.4%	18.0%	0.0%		0.0%	
					Hayspur 3N	99	23.2%	13.4%	48.4%	19.4%	2.5%	6.2%	2.5%	6.2%
		Featherville Dredge Pond	Hagerman	6/13/2011	Normal production	149	32.2%	13.4%	45.0%	16.2%	0.0%		0.0%	
		Freedom Park Pond	Hagerman	4/20/2011	Normal production	74	0.0%		0.0%		0.0%		0.0%	
		Lake Walcott	Hagerman	4/12/2011	High density	200	0.0%		0.0%		0.0%		0.0%	
					Low density	200	5.8%	4.7%	6.7%	5.1%	2.5%	4.4%	2.5%	4.4%
		Little Camas Reservoir	Hagerman	4/11/2011	Normal production	397	19.3%	7.0%	21.7%	7.6%	3.7%	4.0%	5.6%	5.1%
		Little Wood Reservoir	Nampa	6/21/2011	High density	200	7.7%	5.5%	13.4%	7.4%	2.5%	4.4%	5.0%	6.4%
					Low density	199	13.5%	7.4%	15.4%	8.0%	6.2%	7.2%	8.7%	8.7%
					Medium density	200	6.7%	5.1%	11.5%	6.8%	9.9%	9.4%	11.2%	10.1%
					Normal production	199	3.9%	3.9%	4.8%	4.3%	7.5%	8.0%	10.0%	9.4%
		Magic Valley Reservoir	American Falls	4/26/2011	High density	200	0.0%		0.0%		1.2%	3.1%	1.2%	3.1%
					Low density	200	3.8%	3.8%	4.8%	4.3%	0.0%		0.0%	
					Medium density	200	1.0%	1.9%	1.0%	1.9%	1.2%	3.1%	1.2%	3.1%
			Hagerman	11/2/2011	Clearsprings 2N	199	15.4%	8.0%	25.1%	10.5%	8.7%	8.7%	10.0%	9.4%
					Hayspur 3N	200	15.3%	8.0%	23.0%	10.0%	8.7%	8.7%	8.7%	8.7%
				4/26/2011	High density	200	5.8%	4.7%	5.8%	4.7%	1.2%	3.1%	1.2%	3.1%
					Low density	200	1.9%	2.7%	2.9%	3.3%	1.2%	3.1%	1.2%	3.1%
			Nampa	4/26/2011	High density	200	1.0%	1.9%	1.9%	2.7%	2.5%	4.4%	3.7%	5.4%
					Low density	200	3.8%	3.8%	4.8%	4.3%	1.2%	3.1%	1.2%	3.1%
					Medium density	195	0.0%		0.0%		0.0%		0.0%	
		Roseworth Reservoir	Hagerman	4/6/2011	High density	200	3.8%	3.8%	4.8%	4.3%	1.2%	3.1%	1.2%	3.1%
					Low density	200	7.7%	5.5%	9.6%	6.2%	2.5%	4.4%	3.7%	5.4%
		Rupert Gravel Pond	Hagerman	4/19/2011	Normal production	149	0.0%		0.0%		0.0%		0.0%	
		Salmon Falls Creek Reservoir	American Falls	4/19/2011	High density	200	1.0%	1.9%	1.0%	1.9%	3.7%	5.4%	3.7%	5.4%
					Low density	200	5.8%	4.7%	10.5%	6.5%	6.2%	7.2%	7.4%	8.0%
					Medium density	200	5.8%	4.7%	7.7%	5.5%	3.7%	5.4%	3.7%	5.4%
			Hagerman	4/19/2011	High density	200	3.8%	3.8%	5.8%	4.7%	3.7%	5.4%	3.7%	5.4%
					Low density	200	8.6%	5.8%	14.4%	7.7%	3.7%	5.4%	3.7%	5.4%
				9/8/2011	Normal production	400	7.2%	3.9%	8.6%	4.3%	1.9%	2.7%	1.9%	2.7%
			Nampa	4/19/2011	High density	200	0.0%		2.9%	3.3%	0.0%		1.2%	3.1%
					Low density	199	2.9%	3.3%	4.8%	4.3%	1.2%	3.1%	1.2%	3.1%
					Medium density	198	2.9%	3.3%	3.9%	3.9%	1.3%	3.1%	1.3%	3.1%
5	Arnie Brimmer	American Falls Reservoir	American Falls	5/31/2011	Normal production	888	6.5%	2.6%	8.8%	3.2%	4.7%	3.4%	8.1%	5.0%
	Koenig Martin	American Falls Reservoir	American Falls	10/18/2011	Normal production	399	1.9%	1.9%	4.3%	3.0%	2.5%	3.2%	3.7%	4.0%
				4/11/2011	High density	200	5.8%	4.7%	5.8%	4.7%	7.4%	8.0%	7.4%	8.0%
					Low density	200	1.0%	1.9%	1.0%	1.9%	3.7%	5.4%	3.7%	5.4%
					Medium density	200	3.8%	3.8%	3.8%	3.8%	2.5%	4.4%	2.5%	4.4%
		Blackfoot Reservoir	Hagerman	9/27/2011	Normal production	399	7.2%	3.9%	11.5%	5.1%	13.7%	9.0%	14.9%	9.6%
		Chesterfield Reservoir	American Falls	5/17/2011	High density	275	2.1%	2.4%	2.1%	2.4%	0.0%		0.0%	
					Low density	200	0.0%		1.9%	2.7%	0.0%		0.0%	
					Medium density	200	1.9%	2.7%	2.9%	3.3%	0.0%		0.0%	
			Hagerman	5/17/2011	High density	200	0.0%		0.0%		1.2%	3.1%	1.2%	3.1%
					Low density	200	4.8%	4.3%	6.7%	5.1%	2.5%	4.4%	3.7%	5.4%
				10/14/2011	Normal production	400	13.4%	5.6%	26.4%	8.6%	8.1%	6.4%	8.7%	6.7%
			Nampa	5/17/2011	High density	200	1.0%	1.9%	1.9%	2.7%	1.2%	3.1%	1.2%	3.1%
					Low density	200	0.0%		0.0%		0.0%		0.0%	
					Medium density	200	0.0%		1.0%	1.9%	2.5%	4.4%	3.7%	5.4%
		Deep Creek Reservoir	Hagerman	5/10/2011	High density	200	9.6%	6.2%	17.3%	8.5%	1.2%	3.1%	2.5%	4.4%
					Low density	200	16.3%	8.2%	27.8%	11.1%	2.5%	4.4%	2.5%	4.4%
		Devils Creek Reservoir	Hagerman	5/10/2011	High density	200	15.3%	8.0%	21.1%	9.5%	0.0%		0.0%	
					Low density	200	26.8%	10.9%	38.3%	13.4%	0.0%		0.0%	

Region	Tag Coordiantor	Water Body	Hatchery	Tagging Date	Treatment	Tags Released	0-365 Days Post Release				366-720 Days Post Release			
							Harvest		Total Catch		Harvest		Total Catch	
							Estimate	90% C.I.	Estimate	90% C.I.	Estimate	90% C.I.	Estimate	90% C.I.
6	Koenig Martin	Island Park Reservoir	American Falls	6/13/2011	High density	200	23.0%	10.0%	25.9%	10.7%	12.4%	10.7%	13.6%	11.3%
					Low density	200	28.8%	11.3%	34.5%	12.6%	11.2%	10.1%	11.2%	10.1%
					Medium density	200	23.0%	10.0%	29.7%	11.5%	11.2%	10.1%	14.9%	12.0%
			Hagerman	9/21/2011	High density	199	23.1%	10.0%	30.8%	11.8%	5.0%	6.4%	6.2%	7.2%
					Low density	195	34.4%	12.7%	42.3%	14.4%	3.8%	5.6%	3.8%	5.6%
				6/13/2011	High density	199	1.0%	1.9%	1.9%	2.7%	0.0%		1.2%	3.1%
					Low density	200	5.8%	4.7%	9.6%	6.2%	0.0%		0.0%	
			Nampa	6/13/2011	High density	200	4.8%	4.3%	4.8%	4.3%	1.2%	3.1%	1.2%	3.1%
					Low density	199	3.9%	3.9%	3.9%	3.9%	1.2%	3.1%	2.5%	4.4%
					Medium density	200	1.9%	2.7%	3.8%	3.8%	1.2%	3.1%	1.2%	3.1%
		Mackay Reservoir	American Falls	5/17/2011	High density	200	24.0%	10.2%	33.6%	12.4%	2.5%	4.4%	3.7%	5.4%
					Low density	200	24.0%	10.2%	32.6%	12.2%	5.0%	6.4%	6.2%	7.2%
					Medium density	200	32.6%	12.2%	48.9%	15.6%	1.2%	3.1%	2.5%	4.4%
			Mackay	6/3/2011	Normal production	200	19.2%	9.0%	39.3%	13.6%	0.0%		0.0%	
				6/21/2011	Normal production	199	27.0%	10.9%	36.6%	13.1%	8.7%	8.7%	10.0%	9.4%
		Trail Creek Pond	Ashton	6/22/2011	Normal production	50	57.5%	27.4%	84.4%	32.0%	0.0%		0.0%	
				7/12/2011	Normal production	50	26.8%	19.4%	49.9%	25.7%	0.0%		0.0%	
				7/25/2011	Normal production	45	59.6%	29.0%	68.2%	30.6%	0.0%		0.0%	
				8/8/2011	Normal production	55	34.9%	21.0%	59.3%	26.7%	0.0%		0.0%	
				9/7/2011	Normal production	50	30.7%	20.7%	38.3%	22.9%	0.0%		0.0%	
				9/27/2011	Normal production	49	54.8%	27.0%	58.7%	27.8%	0.0%		0.0%	
	Schoby Greg	Ryder Park Pond	American Falls	8/15/2011	Regional evaluation	31	74.2%	36.7%	105.1%	40.5%	0.0%		0.0%	
7	Koenig Martin	Kids Creek Pond	Mackay	8/24/2011	Normal production	49	15.7%	15.2%	27.4%	19.8%	0.0%		5.1%	12.4%
				4/20/2011	Normal production	50	26.8%	19.4%	46.0%	24.9%	0.0%		0.0%	
		Salmon River	Sawtooth	9/20/2011	Normal production	24	0.0%		0.0%		0.0%		0.0%	
				6/23/2011	Normal production	172	20.1%	9.8%	41.2%	14.7%	0.0%		0.0%	
				6/23/2011	Normal production	116	21.5%	12.0%	31.4%	14.6%	0.0%		0.0%	
				6/22/2011	Normal production	56	3.4%	6.7%	17.1%	14.9%	0.0%		0.0%	
				6/23/2011	Normal production	56	13.7%	13.3%	24.0%	17.5%	0.0%		0.0%	
				9/20/2011	Normal production	38	5.0%	9.9%	10.1%	13.9%	0.0%		0.0%	
				9/19/2011	Normal production	38	0.0%		5.0%	9.9%	0.0%		0.0%	
		Stanley Lake	Nampa	6/21/2011	High density	200	11.5%	6.8%	21.1%	9.5%	1.2%	3.1%	1.2%	3.1%
					Low density	200	20.1%	9.2%	29.7%	11.5%	0.0%		0.0%	
					Medium density	200	11.5%	6.8%	18.2%	8.7%	0.0%		0.0%	
					Normal production	200	9.6%	6.2%	18.2%	8.7%	0.0%		0.0%	

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