FISH RESEARCH PROJECT
OREGON

STEELHEAD ESCAPEMENT MONITORING IN THE UPPER GRANDE RONDE RIVER BASIN

ANNUAL TECHNICAL REPORT

CONTRACT PERIOD: August 1, 2010 to July 31, 2011

Prepared By:

Marika E. Dobos
Christopher D. Horn
Edwin R. Sedell
and
James R. Ruzycki

Oregon Department of Fish and Wildlife
203 Badgley Hall, EOU
One University Blvd.
La Grande, OR 97850

Funded By:

Bonneville Power Administration
905 NE 11th Ave
Portland, OR 97232

Contract Number: IGC 51891

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Executive Summary

Objectives

1. Estimate redd density and spawner escapement of summer steelhead for the Upper Grande Ronde River summer steelhead population.
2. Estimate spawners/redd above adult weir collection points and correlate independent counts.

Accomplishments and Findings

We sampled 28 random, spatially-balanced sites throughout the Upper Grande Ronde River (UGRR) basin during the spring of 2011. Survey sites encompassed 56 km (0.6%) of an estimated 929 km of total steelhead spawning distribution within the basin. A total of 132 surveys were conducted from 7 March through 7 July to determine summer steelhead (*Oncorhynchus mykiss)* redd abundance and adult escapement. During these surveys, a total of 44 steelhead redds were observed on 15 of the 28 sites (52%) and 14 live steelhead were observed at 10 of the sites (34%).

On Deer Creek, 28 redds and 51 live steelhead were observed during five survey visits. A total of 133 natural-origin adult steelhead were passed above the weir at the Big Canyon facility resulting in a 4.75 fish/redd ratio for the 2011 spawning season. Total distance of the Deer Creek survey was 16.4 km resulting in a density of 1.7 redds/km. Using the fish/redd ratio extrapolated from Deer Creek surveys, redd abundance and adult steelhead escapement for the UGRR basin were estimated at 730 and 3,467 respectively. Fewer redds were found than last year. High snow pack and several high flow events made survey conditions difficult and limited our ability to complete some surveys on designated dates.

Only two survey sites were selected in the Lookingglass Creek watershed and two in the Catherine Creek watershed. One of those in South Fork Catherine Creek was removed from the sample set because of inaccessibility (snow and high discharge).

Management Recommendations

1. Using the current data of steelhead spawning distribution and geographic landscape variables, refine the sampling universe for *O. mykiss* in the Upper Grande Ronde River basin to improve our knowledge of steelhead spawning distribution.
2. Determine the level of change in the escapement estimate that we would consider to be biologically and statistically significant in order to determine short- and long-term population changes.
3. Determine better methods for standardizing escapement estimates such as integrating redd life and offering better training options for new surveyors.
4. Continue to manage the Upper Grande Ronde River basin exclusively for natural-origin steelhead and determine the extent and distribution of hatchery steelhead in the basin through observations of hatchery fish during the spawning season.

Acknowledgements

We would like to acknowledge the assistance and cooperation of the many private landowners throughout the UGRR basin who allowed us access to their property. The cooperation of private landowners was essential in meeting our project objectives. Additionally, we would also like to thank Tim Bailey and Jeff Zakel for providing much needed guidance and advice regarding steelhead spawning ground surveys. The information they provided was helpful for survey planning and landowner contacts. Nadine Craft provided information regarding index spawner surveys and Mike McLean provided data from weir collections. Further, we would like to acknowledge our field crew members Caitlin Ecklund, Aaron Bliesner, and Andrew Van Sickle for their assistance. Funding was provided by BPA.

Introduction

The UGRR basin supports a population of summer steelhead that has been segregated from three other populations in the entire Grande Ronde River basin based on topographic, genetic, observational, and other evidence of interactions. Historically, the Grande Ronde River was one of the more significant anadromous fish producing rivers in the Columbia River Basin. Summer steelhead in the Grande Ronde River basin compose part of the Snake River Distinct Population Segment (DPS) and are listed as threatened under the Endangered Species Act (62 FR 43937; August 18,1997). Despite recovery efforts, these populations remain depressed relative to historic levels.

This project annually evaluates summer steelhead population abundance for the UGRR by conducting surveys of redds and spawning activity. These surveys provide the data needed to estimate adult steelhead escapement, improve our understanding of habitat utilization, and contribute to productivity and survival estimates for this population. Steelhead were monitored using a probabilistic sampling approach that incorporates a sample-site selection procedure created for the Environmental Protection Agency's environmental monitoring and assessment program (EMAP). We used this EMAP design to select sample sites for status and trend monitoring of steelhead redds within the UGRR watershed. This method allowed us to sample spatially balanced survey sites distributed within the basin, and followed the Oregon Plan for Salmon and Watersheds Monitoring Program approach (Stevens 2002).

Study Area

The Grande Ronde River flows generally northeast 341 km from its origin to join the Snake River at river kilometer (rkm) 271, about 32 rkm upstream of Asotin, WA and 793 rkm from the mouth of the Columbia River. The UGRR sub-basin (Figure 1) is a portion of the entire Grande Ronde River watershed. The UGRR basin includes the Grande Ronde River and its tributaries from the headwaters to the confluence with the Wallowa River (rkm 131). The UGRR drains approximately 4,272 km^2, with a perimeter of 425 km and contains 1,475 km of streams (1,178 km of anadromous salmonid habitat). Elevations in the watershed range from 705 m at the confluence of the Grande Ronde and Wallowa Rivers to over 2,135 m in the headwater areas. The Grande Ronde River begins in the Blue Mountains at Grande Ronde Lake (near the Anthony Lakes recreation area), flows north, then northeast and through the cities of La Grande (rkm 249) and Island City (rkm 253). Stream physiography is similar to other western,

inter-mountain systems until reaching the main portion of the Grande Ronde valley (roughly around Island City for the UGRR and the town of Union for Catherine Creek). The main portion of the valley is flat (stream gradient <0.1%), and stream sinuosity increases and velocity slows accordingly. This valley was historically a large wetland complex, but now is primarily in agricultural production. Gradient then increases again after the UGRR passes through Rinehart Gap near the town of Elgin (rkm 153) and enters a canyon-dominated landscape.

The Upper Grande Ronde summer steelhead population is recognized as encompassing the Grande Ronde River and its tributaries above the confluence with the Wallowa River. Major tributaries of the UGRR include Lookingglass Creek (rkm 138), Catherine Creek (rkm 225), Meadow Creek (rkm 290) and Sheep Creek (rkm 312). Steelhead from Dry Creek, a genetic outlier, is included in this population. Like other outliers, this may reflect the contribution of resident fish to the sample. Steelhead spawning distribution in the UGRR basin was determined by historic and recent spawning ground and habitat surveys that defined spawning distribution and barriers to anadromy.

Deer Creek, a tributary of the Wallowa River, was also surveyed to determine a adult fish/redd ratio. A concrete fish acclimation facility (Big Canyon), with a complete weir, is located approximately 0.25 km from the mouth of Deer Creek. Natural-origin adult steelhead were passed above the weir during their spawning migrations. Thus, a known number of adult steelhead were in the creek during spawning surveys, allowing us to determine the adult fish/redd ratio for extrapolation to the larger UGRR basin (Flesher et al. 2005; Gee et al. 2008; Lance Clarke and Jim Ruzycki, ODFW, unpublished data).

Methods

Sampling Domain and Site Selection

Sites were selected using a Generalized Random Tessellation Stratification (GRTS) survey design, a spatially balanced random sampling design developed for EMAP (Stevens 2002, Jacobs et al. 2009). Sample sites were limited to the current steelhead spawning distribution. These limits were defined by redd and fish counts from spawning ground surveys and barriers identified during habitat surveys for summer steelhead. This information is annually updated to include newly identified barriers as well as new reaches of spawning habitat. All reaches upstream of known barriers to anadromous fish passage were eliminated from the potential sampling area. Thirty sample sites were targeted each year. In order to balance the needs of status (more random sites) and trend (more repeat sites) monitoring, the following rotating panel design was implemented:

- 10 sites repeated every year (annual)
- 10 sites repeated once every 3 years on a staggered basis
- 10 sites new every year (new)

A Geographic Information System (GIS) incorporating a 1:100,000 digital stream network was used to insure an unbiased and spatially balanced selection of sample sites. The GIS site selection process generated geographic coordinates (i.e. latitude and longitude) for each candidate site (Figure 2, Table 1). A two kilometer reach was established encompassing each candidate site. Topographic maps were produced showing the beginning and end of each survey

reach, along with the included GRTS sample point. Landowner contacts were then developed based on county plat maps. With the assistance of ODFW district biologists, permission was sought from landowners for survey sites. In the field, crews used a handheld Global Positioning System (GPS) to locate the established survey reaches which encompassed the selected GRTS sample points. Some candidate sites were not sampled due to denial of permission from private landowners or because sites were located upstream of previously unknown fish passage barriers. In such events, replacement sites were drawn from a pre-selected list of over-sample sites. Every year the EMAP sampling universe is refined based on field observations of previously unknown barriers and other restrictions (e.g. dry streams) that limit fish life history stages (defined as "Excluded Reaches"), or the removal of barriers (e.g. road culverts) that limited access to habitat.

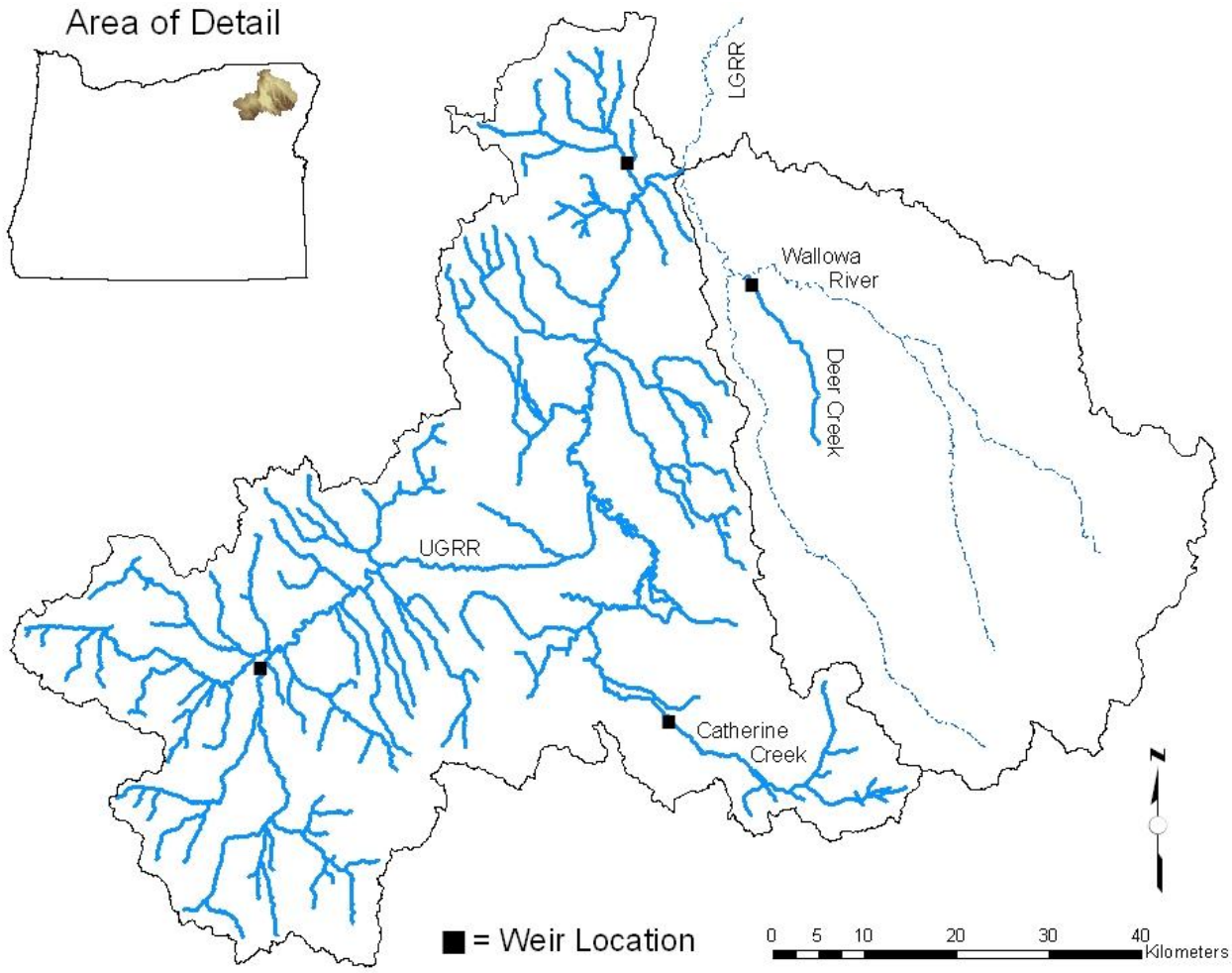

Figure 1. Streams within the steelhead spawning distribution of the Upper Grande Ronde River basin and the reference stream, Deer Creek. In-stream weir trap locations are also noted.

Steelhead Redd Surveys

Steelhead redd surveys were based on standard ODFW methods (Susac and Jacobs 1999; Jacobs et al. 2000; Jacobs et al. 2001) and were conducted from March to early July, 2011 (Table 2). Individual sites were surveyed up to eight times to quantify the number of redds constructed at each site, with approximately three week intervals between successive surveys to account for the temporal variation in spawning activity. Normally a two week interval is attempted, but snow and discharge conditions prevented achievement of the normal interval. Generally, surveyors walked upstream from the bottom of each sample reach and counted all redds, live fish, and carcasses observed. Five Points Creek and Deer Creek were surveyed downstream and in some cases other surveys were conducted downstream for safety. New redds were flagged and the locations marked with a handheld GPS unit.

During each visit, surveyors recorded the number of new redds as well as the number of previously identified and flagged redds. Redd visibility was rated for previously flagged redds, ranging from 1 (most visible) to 5 (least visible). Newly identified redds were considered most visible (=1). Surveyors rotated through different sites throughout the season to prevent the same individual from observing a site in successive weeks, and to reduce any associated bias.

Overall mean redd density (R_D) was estimated by summing redd observations at individual survey sites (i) as:

$$R_D = \sum_{i=1}^{n} r_i \Big/ \sum_{i=1}^{n} d_i \qquad (1)$$

where r_i is the number of unique redds observed at site i, d_i is the distance surveyed (km) at site *i*. The total number of redds (R_T) occurring throughout the basin was estimated by:

$$R_T = R_D \cdot d_u \qquad (2)$$

where d_u is the total kilometers available to steelhead for spawning and rearing (929 km). Steelhead escapement (E_S) was then estimated by:

$$E_S = 4.75 \cdot R_T \qquad (3)$$

where 4.75 is the fish per redd constant developed from Deer Creek surveys. This constant or weighting value represents a single spawning year. A locally weighted neighborhood variance estimator (Stevens and Olsen 2004), which incorporates the pair-wise dependency of all points and the spatially constrained nature of the design, was used to estimate a 95% confidence interval of the escapement estimate using R statistical software (R Development Core Team 2005).

Steelhead carcasses were examined to obtain population and life history information (age, sex, length, and spawner origin). For all carcasses, surveyors collected scale samples from the key scale area (Nicholas and Van Dyke 1982) for age determination, recorded sex, measured MEPS length (middle of eye to posterior scale), and determined spawner origin (hatchery or natural-origin) by inspecting carcasses for the presence (natural-origin) or absence (hatchery) of an adipose fin. The proportion of hatchery to natural-origin steelhead was calculated by dividing the total number of fin marked fish by all fish that could be observed for marks (live fish only).

The number of hatchery fish straying to the basin was estimated by multiplying this proportion of hatchery and natural-origin steelhead by our estimate of steelhead escapement.

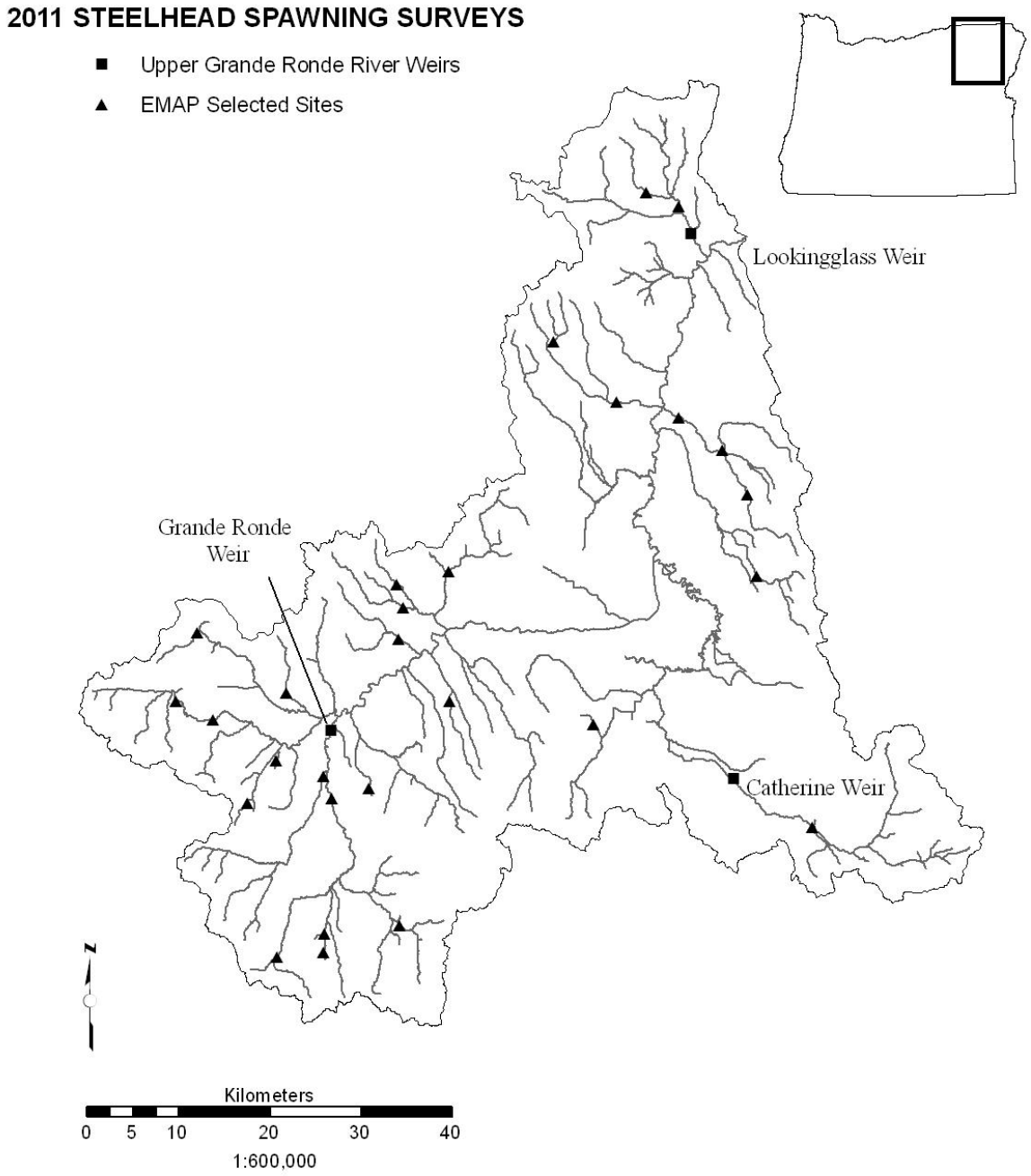

Figure 2. Map of the EMAP selected GRTS points where surveys were conducted in the spring of 2011 and the weir facilities where adults were passed and counted in the Upper Grande Ronde River basin.

Table 1. Identification number, stream, status, panel, coordinates for GRTS points (UTM-NAD27), and start and end coordinates for survey sites during 2011.

Site ID	Stream	Status	Panel	UTM Zone	GRTS Coordinates		Start Coordinates		End Coordinates	
					Easting	Northing	Easting	Northing	Easting	Northing
104	Grande Ronde River	Annual	1	11	390432	5005389	390432	5005389	390852	5003771
105	East Phillips Creek	Annual	1	11	416396	5052712	416396	5052712	417743	5053809
106	Five Points Creek	Annual	1	11	404307	5028459	404307	5028459	405970	5029285
107	Burnt Corral Creek	Annual	1	11	382183	5004526	382183	5004526	380725	5003360
108	West Chicken Creek	Annual	1	11	389482	4988843	389482	4988843	389348	4987112
109	Clark Creek	Annual	1	11	435197	5040570	435197	5040570	435955	5038825
110	Spring Creek	Annual	1	11	399215	5021324	399215	5021324	397621	5022291
111	Meadow Creek	Annual	1	11	379739	5014229	379739	5014229	378270	5013398
113	Phillips Creek	Annual	1	11	424074	5046398	424074	5046398	422474	5046704
115	Meadow Creek	Annual	1	11	374325	5015697	374325	5015697	373596	5016682
117	Little Lookingglass Creek	New	1	11	431696	5067052	431696	5067052	431039	5068546
119	Sheep Creek	New	1	11	384627	4988266	384627	4988266	383791	4986879
120	Little Beaver Creek	New	1	11	395123	5006290	395123	5006290	395223	5004379
122	Dry Creek	New	1	11	400845	5024591	400845	5024591	399100	5025226
124	Grande Ronde River	New	1	11	396884	4990810	396884	4990810	398226	4989617
125	Clark Creek	New	1	11	430600	5044402	430551	5044407	431961	5043603
126	Fly Creek	New	1	11	390505	5007208	390505	5007208	389736	5005658
127	McIntyre Creek	New	1	11	387604	5014905	387604	5014905	386294	5016321
128	Ladd Creek	New	1	11	419886	5011166	419886	5011166	419454	5012592
130	Whiskey Creek	New	1	11	404422	5015792	404422	5015792	404302	5013662
131	McCoy Creek	New	1	11	378191	5022023	378191	5022023	376638	5022907
132	Catherine Creek	New	1	11	441788	5000088	441788	5000088	443305	4998789
133	Mottet Creek	New	1	11	428943	5068751	428943	5068751	427448	5069678
136	West Chicken Creek	New	1	11	389713	4990846	389713	4990846	389518	4989000
138	Pelican Creek	New	1	11	399369	5027166	399369	5027166	398113	5028510
139	Tybow Creek	New	1	11	385233	3009761	385233	3009761	384744	5007829
140	Indian Creek	New	1	11	438153	5027431	438153	5027431	439293	5025976
141	Clark Creek	New	1	11	437123	5036799	437123	5036799	437764	5035493

Results

Deer Creek Surveys

We observed 28 steelhead redds and 51 live adult steelhead in Deer Creek above the Big Canyon weir during 2011. Normally, 18.5 km of the creek would be surveyed, but high snow pack and stream discharge prevented surveys in the uppermost portions. Resultantly, only 16.4 km (Sage Creek confluence to weir) of the normal 18.5 km were surveyed in 2011. Five surveys were completed, with an average of 22 days between each. Survey dates were 24 March, 12 April, 21 April, 4 May, and 1 June. The weir was removed on 6 June, and due to high flows, no more surveys were conducted. Total redd density for 2011 was 1.7 redds/km.

At the Big Canyon weir, 133 adult natural-origin steelhead (75 female, 58 male) were passed upstream into Deer Creek, leading to a 4.75 fish/redd ratio. The first fish were trapped and passed above the weir on 11 March (one female, two males), and the last on 19 May (one female, one male). The total number of adult natural-origin steelhead passed in 2011 was only one fewer than 2010 (134) and substantially more than 2009 (+66%) and 2008 (+118%).

Upper Grande Ronde Surveys

We observed 44 steelhead redds and 14 live adult steelhead while surveying 56 km of an estimated 929 km (0.6%) of available steelhead spawning habitat within the UGRR basin (Table 3). Calculated redd density was 0.79 redds/km. By expansion, 730 redds were assumed to exist within the UGRR basin in 2011, constructed by an estimated 3,467 spawners (95% CI: 2,416 – 4,518) (Table 4). Redds were observed at fifteen of the 28 sites (52%) and live steelhead were observed at ten sites (34%). Redds were observed at all sites where adult steelhead were seen. No hatchery steelhead were observed in 2011 on any of the UGRR sites. The average time period between surveys among all sites was 21 days.

Adult steelhead were captured and unmarked (natural-origin) fish were passed above three weirs operated by the Confederated Tribes of the Umatilla Indian Reservation (CTUIR) in the UGRR basin. During the spring of 2011, 278 natural-origin adult steelhead were passed at Lookingglass weir, 348 at the Catherine Creek weir, and 11 at the Grande Ronde River weir. A total of 638 adult steelhead were passed, similar to numbers from 2010 (n = 632), and substantially more than 2009 (n = 378, +69%) and 2008 (n = 274, +127%).

Steelhead Spawning Timing

Steelhead redds were observed throughout the watershed, with the highest redd densities occurring in the extreme upstream portion of the UGRR drainage (Figure 3). New steelhead redds were discovered from late March through late June, 2011 (Figure 4). The first new redd was observed on Fly Creek on 22 March while the last new redds were observed on Pelican Creek and Dry Creek on 28 June, 2011. Seven of the 44 (16%) new redds were observed in the month of March, 16 redds (36%) in April, 17 redds (39%) in May, and 4 redds (9%) in June. High flows that peaked in May and persisted through June negatively influenced our ability to observe new redds and decreased the visibility of previously identified redds.

Most redds were observed prior to the main peaks in river discharge. The Grande Ronde River flows first peaked on 15 May increasing from 122 ft^3/s to 364 ft^3/s in two days (Figure 5). Prior to this peak, 36 of the total 44 redds (82%) were observed on surveys. Deer Creek discharge peaked on/near 15 May (used surrogate USGS gauge #13330500 at neighboring Bear Creek for data) prior to which 26 of the total 28 redds (93%) were observed on surveys (Figure 6).

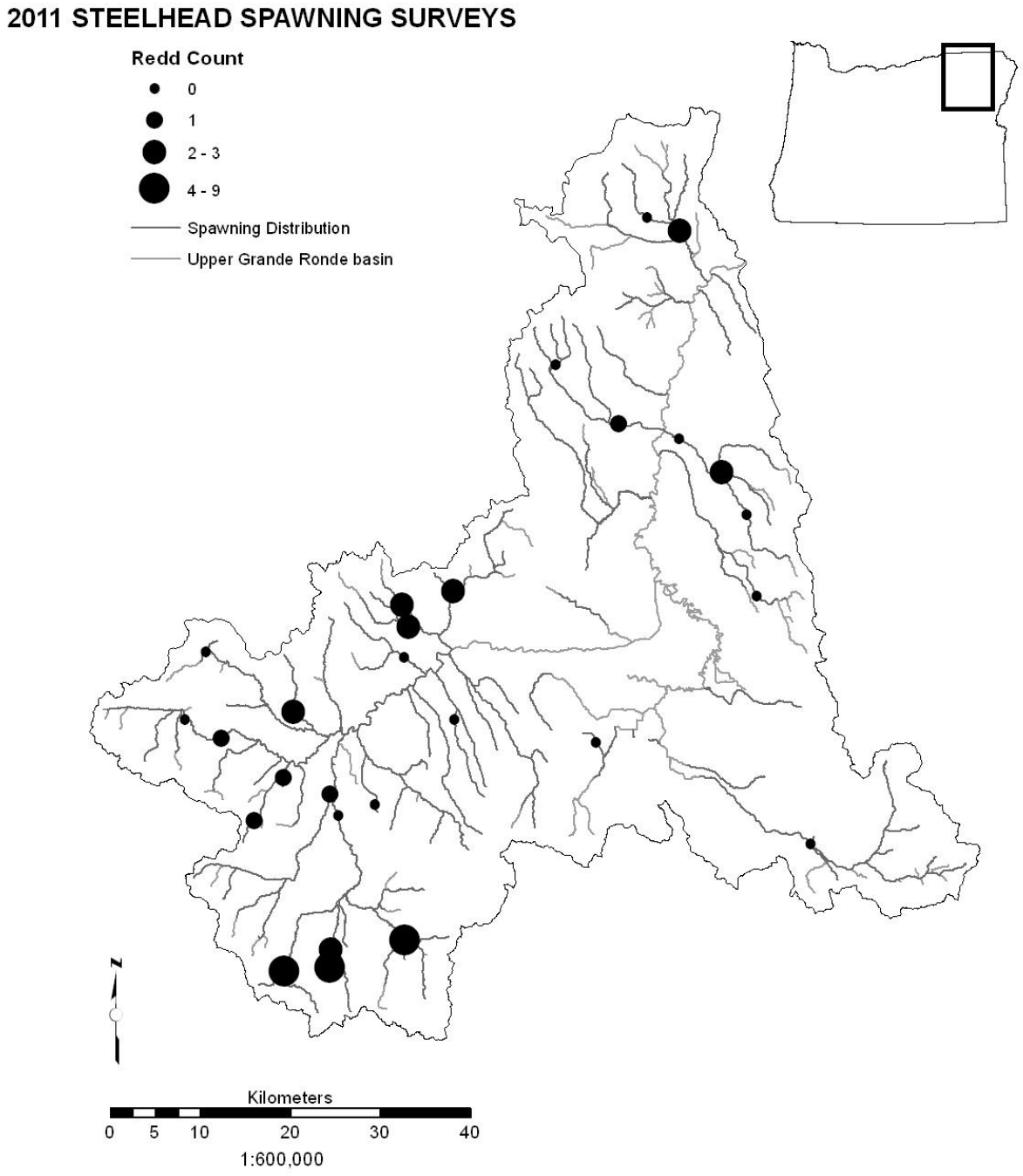

Figure 3. Map of the Upper Grande Ronde River basin showing density of redds observed on EMAP survey sites and the total spawning use of steelhead in the basin during 2011.

Table 2. Total number of surveys completed at each site and all dates when surveys were conducted for 2011 steelhead spawning surveys.

Site ID	Stream	Total # of Surveys Completed	1st Survey Date	2nd Survey Date	3rd Survey Date	4th Survey Date	5th Survey Date	6th Survey Date	7th Survey Date	8th Survey Date
104	Grande Ronde River	3	3/8/2011	3/23/2011	7/7/2011					
105	East Phillips Creek	5	4/18/2011	5/3/2011	5/24/2011	6/7/2011	6/22/2011			
106	Five Points Creek	3	4/25/2011	5/9/2011	6/15/2011					
107	Burnt Corral Creek	4	3/30/2011	5/3/2011	5/31/2011	6/21/2011				
108	West Chicken Creek	5	4/19/2011	5/2/2011	5/25/2011	6/8/2011	6/21/2011			
109	Clark Creek	7	3/10/2011	3/25/2011	4/6/2011	4/26/2011	5/25/2011	6/9/2011	6/27/2011	
110	Spring Creek	5	3/16/2011	4/25/2011	5/10/2011	6/2/2011	6/13/2011			
111	Meadow Creek	8	3/14/2011	3/28/2011	4/14/2011	4/27/2011	5/12/2011	5/24/2011	6/8/2011	6/21/2011
113	Phillips Creek	6	3/7/2011	3/23/2011	4/4/2011	4/26/2011	6/1/2011	6/16/2011		
115	Meadow Creek	4	5/2/2011	5/23/2011	6/6/2011	6/20/2011				
117	Little Lookingglass Creek	5	3/21/2011	4/26/2011	5/25/2011	6/9/2011	6/22/2011			
119	Sheep Creek	5	4/18/2011	5/2/2011	5/24/2011	6/8/2011	6/21/2011			
120	Little Beaver Creek	3	5/5/2011	6/6/2011	6/28/2011					
122	Dry Creek	6	3/17/2011	4/11/2011	4/26/2011	5/10/2011	6/6/2011	6/28/2011		
124	Grande Ronde River	6	3/30/2011	4/14/2011	4/28/2011	5/9/2011	5/31/2011	7/7/2011		
125	Clark Creek	3	5/25/2011	6/14/2011	6/27/2011					
126	Fly Creek	3	3/22/2011	4/25/2011	7/7/2011					
127	McIntyre Creek	7	3/14/2011	3/28/2011	4/11/2011	4/25/2011	5/9/2011	5/26/2011	6/8/2011	
128	Ladd Creek	2	3/14/2011	3/29/2011						
130	Whiskey Creek	6	3/22/2011	4/4/2011	4/19/2011	5/2/2011	6/6/2011	6/21/2011		
131	McCoy Creek	4	5/11/2011	5/24/2011	6/6/2011	6/20/2011				
132	Catherine Creek	3	3/23/2011	4/4/2011	4/28/2011					
133	Mottet Creek	4	4/18/2011	5/25/2011	6/7/2011	6/22/2011				
136	West Chicken Creek	8	3/15/2011	3/28/2011	4/14/2011	4/28/2011	5/9/2011	5/23/2011	6/8/2011	6/21/2011
138	Pelican Creek	5	4/28/2011	5/10/2011	6/2/2011	6/13/2011	6/28/2011			
139	Tybow Creek	7	3/15/2011	3/28/2011	4/11/2011	4/27/2011	5/11/2011	5/31/2011	6/14/2011	
140	Indian Creek	2	5/11/2011	6/14/2011						
141	Clark Creek	3	4/27/2011	5/25/2011	6/9/2011					
000	Deer Creek	5	3/24/2011	4/12/2011	4/21/2011	5/4/2011	6/1/2011			

Table 3. Panel number, survey distance, total number of steelhead redds; marked (hatchery), unmarked (natural-origin), and unknown-origin, live steelhead observed during spawning surveys conducted in the UGRR basin from 7 March to 7 June, 2011.

					Live Fish Near Redd			Live Fish Not Near Redd		
Site ID	Stream	Panel	Distance (km)	Total Redds	Ad Clip	No Ad Clip	Unknown	Ad Clip	No Ad Clip	Unknown
104	Grande Ronde River	1	2	0	0	0	0	0	0	0
105	East Phillips Creek	1	2	0	0	0	0	0	0	0
106	Five Points Creek	1	2	3	0	0	0	0	0	0
107	Burnt Corral Creek	1	2	1	0	0	1	0	0	0
108	West Chicken Creek	1	2	8	0	2	0	0	0	1
109	Clark Creek	1	2	2	0	0	0	0	1	0
110	Spring Creek	1	2	0	0	0	0	0	0	0
111	Meadow Creek	1	2	1	0	0	0	0	1	0
113	Phillips Creek	1	2	1	0	0	0	0	0	0
115	Meadow Creek	1	2	0	0	0	0	0	0	0
117	Little Lookingglass Creek	1	2	3	0	0	0	0	0	0
119	Sheep Creek	1	2	4	0	0	0	0	0	1
120	Little Beaver Creek	1	2	0	0	0	0	0	0	0
122	Dry Creek	1	2	2	0	0	0	0	0	0
124	Grande Ronde River	1	2	9	0	1	0	0	0	0
125	Clark Creek	1	2	0	0	0	0	0	0	0
126	Fly Creek	1	2	1	0	2	0	0	0	0
127	McIntyre Creek	1	2	3	0	0	0	0	0	0
128	Ladd Creek	1	2	0	0	0	0	0	0	0
129	Dry Creek	1	2	0	0	0	0	0	0	0
130	Whiskey Creek	1	2	0	0	0	0	0	0	0
131	McCoy Creek	1	2	0	0	0	0	0	0	0
132	Catherine Creek	1	2	0	0	0	0	0	2	0
133	Mottet Creek	1	2	0	0	0	0	0	0	0
136	West Chicken Creek	1	2	3	0	0	0	0	0	0
138	Pelican Creek	1	2	2	0	0	1	0	0	0
139	Tybow Creek	1	2	1	0	0	1	0	0	0
140	Indian Creek	1	2	0	0	0	0	0	0	0
141	Clark Creek	1	2	0	0	0	0	0	0	0
	Total		**56**	**44**	**0**	**5**	**3**	**0**	**4**	**2**

Table 4. Total surveys, redds observed, expansion of redds throughout the basin, and steelhead escapement with 95% confidence intervals for spawning surveys conducted on the Upper Grande Ronde basin from March through June 2008-2011.

Year	Total Surveys	Total Redds Observed	Distance Suveyed (km)	Redds/km	Total Redds (expanded)	Fish/Redd Ratio	Spawner Escapement	Lower 95%CI	Upper 95%CI
2008	29	24	58	0.41	384	4.07	1565	742	2388
2009	30	42	60	0.70	650	3.81	2478	1662	3292
2010	29	109	53	2.06	1911	1.60	3057	2116	3998
2011	28	44	56	0.79	730	4.75	3467	2416	4518

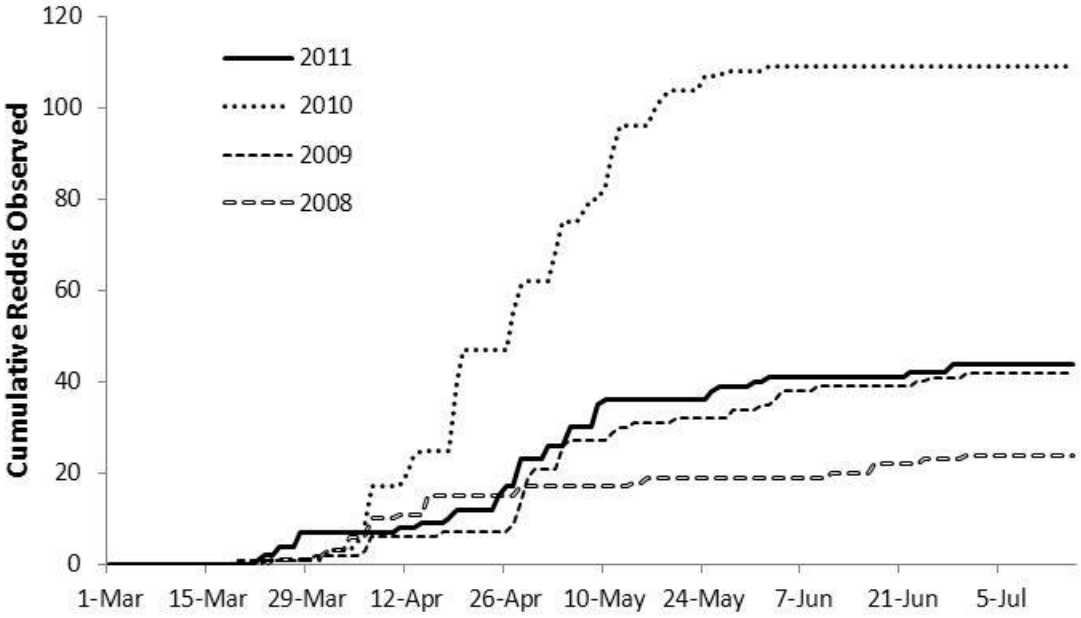

Figure 4. Cumulative redds observed in the Upper Grande Ronde basin for steelhead spawning surveys, 2008 – 2011.

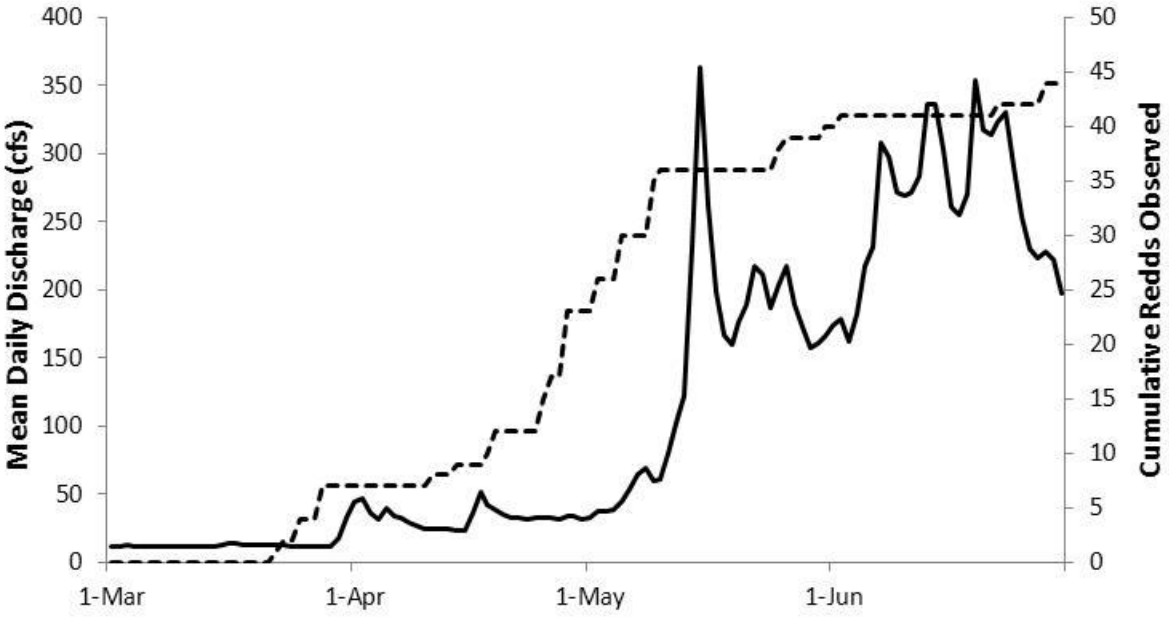

Figure 5. Mean daily discharge (ft^3/s) of the UGRR near Clear Creek (USGS station #13317850) and cumulative redds observed from 1 March through 30 June, 2011.

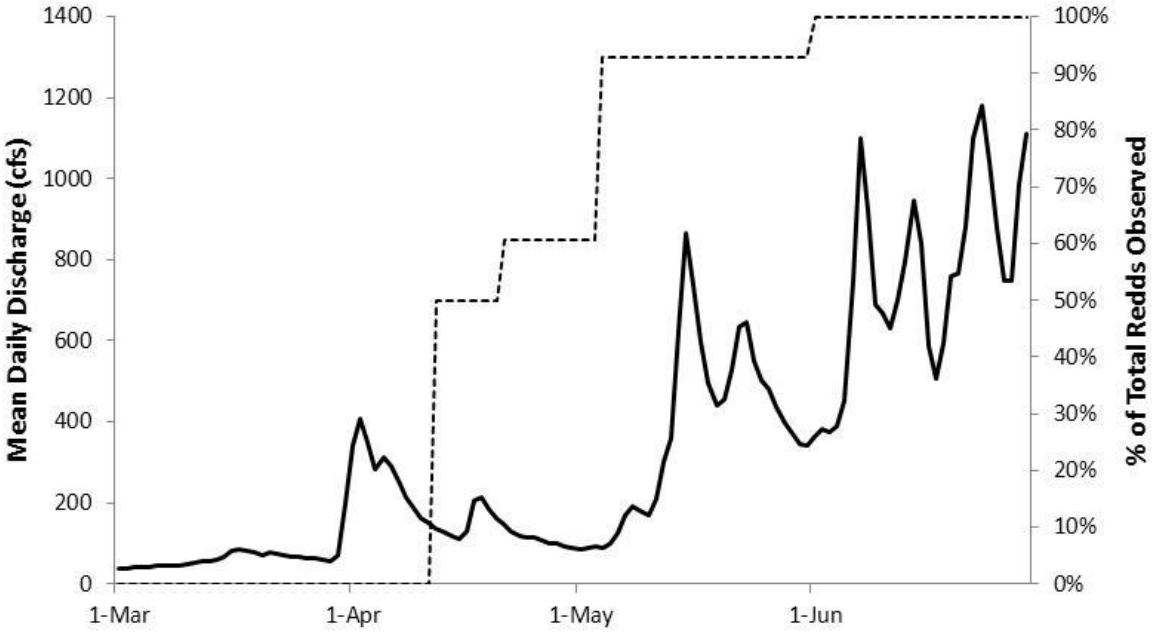

Figure 6. Mean daily discharge (ft^3/s) of Bear Creek (USGS station #13330500) and cumulative percentage of redds observed on Deer Creek from 1 March through 30 June for surveys 2011.

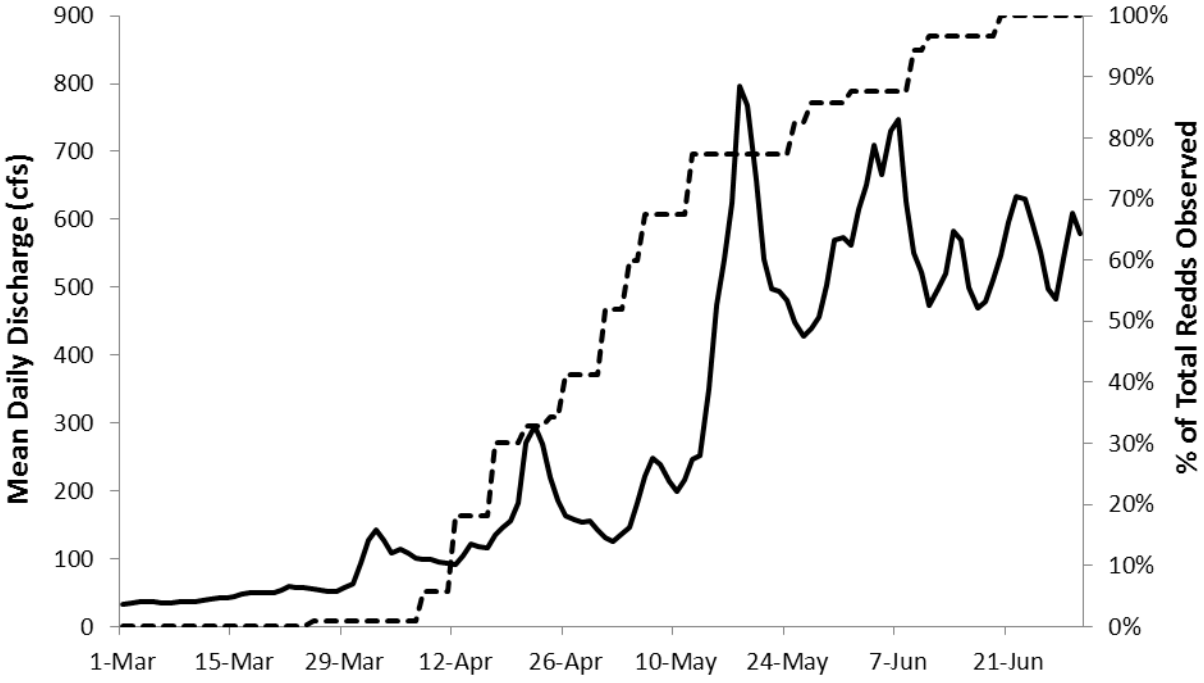

Figure 7. Mean daily discharge (ft3/s) of Bear Creek (USGS station #13330500) and cumulative percentage of redds observed on Deer Creek from 1 March through 30 June for surveys 2008 – 2011.

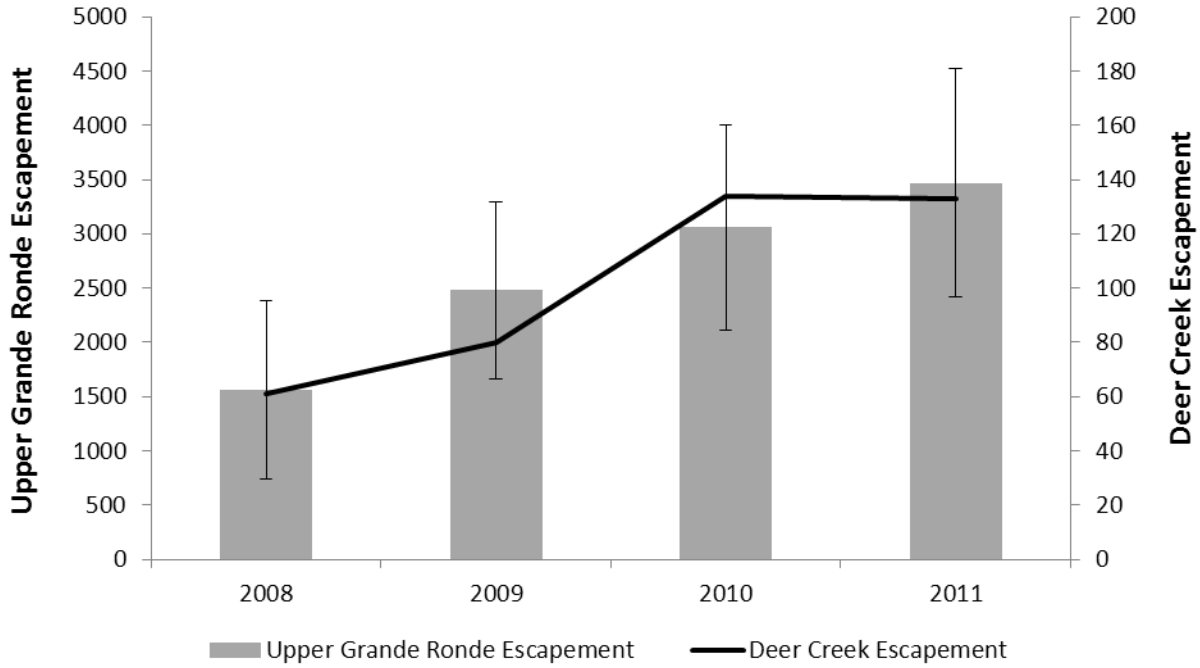

Figure 8. Estimated steelhead escapement (± 95% C.I.), adjusted for new total spawning distribution distance, compared to total adult steelhead passed above Big Canyon weir on Deer Creek.

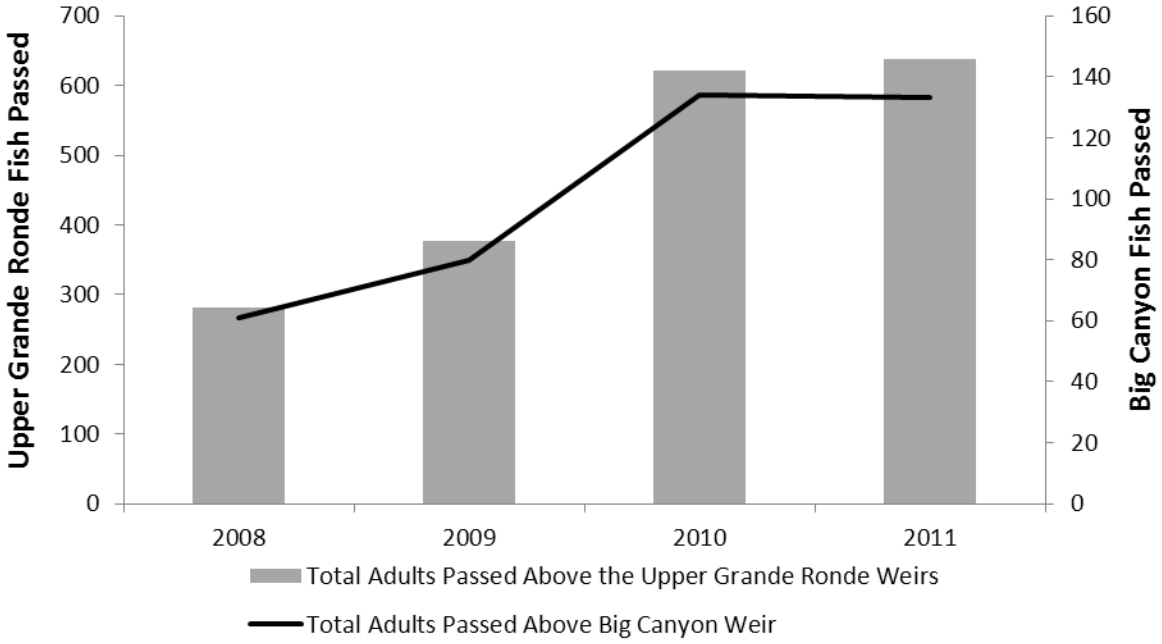

Figure 9. Number of Adult steelhead passed above the UGRR weirs (Lookingglass and Catherine Creeks, and UGRR near Starkey) and number of adults passed above the Big Canyon weir on Deer Creek.

Discussion

Steelhead Escapement

Viewing conditions were marginal to difficult through most of the season, though visibility increased in early June at some survey sites. Streams originating in the Wallowa mountain range held late snow pack resulting in persistent high flows through late spring and early summer. Resultantly, access to high elevation survey sites was limited. One EMAP selected site on the South Fork of Catherine Creek was removed from our sample set because we were unable to safely access it. On average, survey sites could not be surveyed for three weeks between designated survey dates due to poor survey conditions. Under ideal conditions surveys would be completed every two weeks.

Steelhead escapement for the UGRR basin was nearly 3,500 adults, higher than in the previous three years. Estimated escapement has increased steadily since surveys were initiated in 2008 (Figure 8). The relatively high escapement estimate of 2011 was largely due to the high fish/redd ratio calculated in Deer Creek (4.75 fish/redd). Although the 2011 fish/redd ratio was the highest recorded since 2008 (Table 4), it was not excessively higher than three of the past four years. The mean redd density was 0.79 redds/km in 2011, which was slightly higher than 2008 and 2009, but much lower than 2010. It remains unknown how strongly the high water conditions influenced observers' ability to identify redds, but the higher fish/redd ratio provides some correction for that.

The variable distribution of redds throughout known steelhead spawning habitat inflated the confidence interval around our escapement estimate. In particular, observations of zero redds substantially increase the confidence interval, and certain streams are not likely to produce redds regardless of the number of adults returning. Willow Creek, for example, has long reaches of soft bottom substrates and slow currents unsuitable for spawning. Many headwater streams also have inadequate habitat for spawning and only continued site visits will identify these reaches. This year approximately 5 km of Middle Fork Clark Creek was removed from the steelhead spawning distribution due to a barrier identified by surveyors. The barrier consisted of two major falls within a 0.5 km stretch of high gradient stream in a canyon area. We will continue to define the extent of these identified stream reaches unsuitable for spawning and locate similar reaches when they are selected in our sample draw. As the sampling space is refined, incidents of zero redds and high confidence intervals should decrease.

Adult steelhead origin (hatchery vs. natural-origin) was determined for eight of the 14 live adult steelhead observed; all eight retained adipose fins and were considered natural-origin. This small sample alone prevents making any confident conclusions about the composition of adult steelhead in the UGRR basin. However, data from fish weirs operated by CTUIR show very few hatchery-origin strays. All hatchery origin fish were removed and euthanized at the weirs on Lookingglass Creek, Catherine Creek, and the UGRR. During 2011, they removed 3 hatchery adult steelhead from the Lookingglass weir. No hatchery adults were observed at either the Catherine Creek or UGRR weirs. However, both the Catherine Creek and the UGRR weirs did not fish during high flow events that rendered them inoperable. It is likely that many fish passed by the inoperable weirs, and some of those could have been of hatchery origin. Past spawning surveys and CTUIR weir operations have captured only a handful of hatchery-origin adult steelhead in the UGRR basin, and most were at the Lookingglass weir (Ruzycki et al. 2008, Ruzycki et al. 2009, Ruzycki et al. 2010). Weir data coupled with spawning survey data indicate that the UGRR steelhead population remains largely of natural-origin.

Deer Creek Comparison

Data from Deer Creek surveys was used to develop a fish/redd ratio which was used to calculate total adult steelhead escapement in the UGRR basin. Based on known number of natural-origin steelhead that were passed above the Big Canyon weir, we divide that number by redds observed along the available spawning distribution of that watershed. Physical conditions on Deer Creek were similar to that of the UGRR survey sites in 2011. Late snow pack in the Wallowa Mountains resulted in high flows through most of the late spring, limiting the number of visits we could complete. We averaged a similar number of survey visits as the UGRR sites (Table 1) and recorded similar spawning timing with most of the redds observed before the peak in flow that occurred in mid-May (Figure 7). There is no station at Deer Creek where discharge and water level can be recorded but we observed flows from Bear Creek (USFS station #13330500), a neighboring tributary of the Wallowa River to use as an example of flow trends for Deer Creek.

There was an apparent positive relationship between the number of adults passed above the Big Canyon weir with our estimated UGRR escapement (Figure 8). Similarly, the number of adults passed above Lookingglass, Catherine, and Upper Grande Ronde weirs (combined) showed a similar pattern to Deer Creek weir passage (Figure 9). This suggests that escapement trends for summer steelhead in Deer Creek are similar to that of the Upper Grande Ronde basin. This increases our confidence in the validity of UGRR escapement estimates. As more data becomes available, rigorous comparative analyses will be completed on these data.

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Appendix I

Site ID, survey date, stream name, sample panel, number of redds, number of live adult steelhead, and number of carcasses observed for each EMAP survey conducted during the spring of 2011 on the UGRR basin.

							Live Fish Near Redd			Live Fish Not Near Redd				
SiteID	Stream	Panel	Date	Survey	Panel	Redds	Ad-Clip	No-Ad Clip	Unknown	Ad-Clip	No-Ad Clip	Unknown	Resident Trout	Dead Fish
104	Grande Ronde River	1	03/08/2011	1	1	0	0	0	0	0	0	0	None	0
104	Grande Ronde River	1	03/23/2011	2	1	0	0	0	0	0	0	0	None	0
104	Grande Ronde River	1	07/07/2011	3	1	0	0	0	0	0	0	0	None	0
105	East Phillips Creek	1	04/18/2011	1	1	0	0	0	0	0	0	0	None	0
105	East Phillips Creek	1	05/03/2011	2	1	0	0	0	0	0	0	0	None	0
105	East Phillips Creek	1	05/24/2011	3	1	0	0	0	0	0	0	0	None	0
105	East Phillips Creek	1	06/07/2011	4	1	0	0	0	0	0	0	0	None	0
105	East Phillips Creek	1	06/22/2011	5	1	0	0	0	0	0	0	0	Few	0
106	Five Points Creek	1	04/25/2011	1	1	3	0	0	0	0	0	0	None	0
106	Five Points Creek	1	05/09/2011	2	1	0	0	0	0	0	0	0	None	0
106	Five Points Creek	1	06/15/2011	3	1	0	0	0	0	0	0	0	Few	0
107	Burnt Corral Creek	1	03/30/2011	1	1	0	0	0	0	0	0	0	Many	0
107	Burnt Corral Creek	1	05/03/2011	2	1	0	0	0	0	0	0	0	None	0
107	Burnt Corral Creek	1	05/31/2011	3	1	1	0	0	1	0	0	0	None	0
107	Burnt Corral Creek	1	06/21/2011	4	1	0	0	0	0	0	0	0	Many	0
108	West Chicken Creek	1	04/19/2011	1	1	2	0	2	0	0	0	0	Few	0
108	West Chicken Creek	1	05/05/2011	2	1	4	0	0	0	0	0	1	Many	0
108	West Chicken Creek	1	05/25/2011	3	1	2	0	0	0	0	0	0	None	0
108	West Chicken Creek	1	06/08/2011	4	1	0	0	0	0	0	0	0	Many	0
108	West Chicken Creek	1	06/21/2011	5	1	0	0	0	0	0	0	0	Many	0
109	Clark Creek	1	03/10/2011	1	1	0	0	0	0	0	0	0	None	0
109	Clark Creek	1	03/25/2011	2	1	2	0	0	0	0	0	0	Few	0
109	Clark Creek	1	04/06/2011	3	1	0	0	0	0	0	0	0	None	0
109	Clark Creek	1	04/26/2011	4	1	0	0	0	0	0	1	0	None	0
109	Clark Creek	1	05/25/2011	5	1	0	0	0	0	0	0	0	None	0
109	Clark Creek	1	06/09/2011	6	1	0	0	0	0	0	0	0	None	0
109	Clark Creek	1	06/27/2011	7	1	0	0	0	0	0	0	0	None	0

110	Spring Creek	1	03/16/2011	1	1	0	0	0	0	0	0	0	None	0
110	Spring Creek	1	04/25/2011	2	1	0	0	0	0	0	0	0	None	0
110	Spring Creek	1	05/10/2011	3	1	0	0	0	0	0	0	0	None	0
110	Spring Creek	1	06/02/2011	4	1	0	0	0	0	0	0	0	None	0
110	Spring Creek	1	06/13/2011	5	1	0	0	0	0	0	0	0	Few	0
111	Meadow Creek	1	03/14/2011	1	1	0	0	0	0	0	0	0	None	0
111	Meadow Creek	1	03/28/2011	2	1	1	0	0	0	0	1	0	Few	0
111	Meadow Creek	1	04/14/2011	3	1	0	0	0	0	0	0	0	None	0
111	Meadow Creek	1	04/27/2011	4	1	0	0	0	0	0	0	0	None	0
111	Meadow Creek	1	05/12/2011	5	1	0	0	0	0	0	0	0	None	0
111	Meadow Creek	1	05/24/2011	6	1	0	0	0	0	0	0	0	None	0
111	Meadow Creek	1	06/08/2011	7	1	0	0	0	0	0	0	0	None	0
111	Meadow Creek	1	06/21/2011	8	1	0	0	0	0	0	0	0	Few	0
113	Phillips Creek	1	03/07/2011	1	1	0	0	0	0	0	0	0	None	0
113	Phillips Creek	1	03/23/2011	2	1	1	0	0	0	0	0	0	None	0
113	Phillips Creek	1	04/04/2011	3	1	0	0	0	0	0	0	0	None	0
113	Phillips Creek	1	04/26/2011	4	1	0	0	0	0	0	0	0	None	0
113	Phillips Creek	1	06/01/2011	5	1	0	0	0	0	0	0	0	None	0
113	Phillips Creek	1	06/16/2011	6	1	0	0	0	0	0	0	0	Few	0
115	Meadow Creek	1	05/02/2011	1	1	0	0	0	0	0	0	0	None	0
115	Meadow Creek	1	05/23/2011	2	1	0	0	0	0	0	0	0	Few	0
115	Meadow Creek	1	06/06/2011	3	1	0	0	0	0	0	0	0	None	0
115	Meadow Creek	1	06/20/2011	4	1	0	0	0	0	0	0	0	None	0
117	Little Lookingglass Creek	1	03/21/2011	1	1	0	0	0	0	0	0	0	None	0
117	Little Lookingglass Creek	1	04/26/2011	2	1	2	0	0	0	0	0	0	None	0
117	Little Lookingglass Creek	1	05/25/2011	3	1	0	0	0	0	0	0	0	None	0
117	Little Lookingglass Creek	1	06/09/2011	4	1	0	0	0	0	0	0	0	None	0
117	Little Lookingglass Creek	1	06/22/2011	5	1	1	0	0	0	0	0	0	Few	0
119	Sheep Creek	1	04/18/2011	1	1	1	0	0	0	0	0	0	None	0
119	Sheep Creek	1	05/02/2011	2	1	3	0	0	0	0	0	1	None	0
119	Sheep Creek	1	05/24/2011	3	1	0	0	0	0	0	0	0	None	0
119	Sheep Creek	1	06/08/2011	4	1	0	0	0	0	0	0	0	None	0
119	Sheep Creek	1	06/21/2011	5	1	0	0	0	0	0	0	0	None	0
120	Little Beaver Creek	1	05/05/2011	1	1	0	0	0	0	0	0	0	None	0
120	Little Beaver Creek	1	06/06/2011	2	1	0	0	0	0	0	0	0	None	0
120	Little Beaver Creek	1	06/28/2011	3	1	0	0	0	0	0	0	0	None	0

122	Dry Creek	1	03/17/2011	1	1	0	0	0	0	0	0	0	None	0
122	Dry Creek	1	04/11/2011	2	1	0	0	0	0	0	0	0	None	0
122	Dry Creek	1	04/27/2011	3	1	0	0	0	0	0	0	0	None	0
122	Dry Creek	1	05/10/2011	4	1	1	0	0	0	0	0	0	None	0
122	Dry Creek	1	06/06/2011	5	1	0	0	0	0	0	0	0	None	0
122	Dry Creek	1	06/28/2011	6	1	1	0	0	0	0	0	0	Few	0
124	Grande Ronde River	1	03/30/2011	1	1	0	0	0	0	0	0	0	None	0
124	Grande Ronde River	1	04/14/2011	2	1	0	0	0	0	0	0	0	Few	0
124	Grande Ronde River	1	04/28/2011	3	1	5	0	1	0	0	0	0	Many	0
124	Grande Ronde River	1	05/09/2011	4	1	4	0	0	0	0	0	0	None	0
124	Grande Ronde River	1	05/31/2011	5	1	0	0	0	0	0	0	0	Many	0
124	Grande Ronde River	1	07/07/2011	6	1	0	0	0	0	0	0	0	None	0
125	Clark Creek	1	05/25/2011	1	1	0	0	0	0	0	0	0	None	0
125	Clark Creek	1	06/04/2011	1	1	0	0	0	0	0	0	0	Few	0
125	Clark Creek	1	06/27/2011	3	1	0	0	0	0	0	0	0	Few	0
126	Fly Creek	1	03/22/2011	1	1	1	0	2	0	0	0	0	None	0
126	Fly Creek	1	04/25/2011	2	1	0	0	0	0	0	0	0	None	0
126	Fly Creek	1	07/07/2011	3	1	0	0	0	0	0	0	0	Few	0
127	McIntyre Creek	1	03/14/2011	1	1	0	0	0	0	0	0	0	None	0
127	McIntyre Creek	1	03/28/2011	2	1	1	0	0	0	0	0	0	None	0
127	McIntyre Creek	1	04/11/2011	3	1	1	0	0	0	0	0	0	None	0
127	McIntyre Creek	1	04/25/2011	4	1	0	0	0	0	0	0	0	None	0
127	McIntyre Creek	1	05/09/2011	5	1	0	0	0	0	0	0	0	None	0
127	McIntyre Creek	1	05/26/2011	6	1	1	0	0	0	0	0	0	None	0
127	McIntyre Creek	1	06/08/2011	7	1	0	0	0	0	0	0	0	None	0
128	Ladd Creek	1	03/14/2011	1	1	0	0	0	0	0	0	0	None	0
128	Ladd Creek	1	03/29/2011	2	1	0	0	0	0	0	0	0	None	0
130	Whiskey Creek	1	03/22/2011	1	1	0	0	0	0	0	0	0	Few	0
130	Whiskey Creek	1	04/04/2011	2	1	0	0	0	0	0	0	0	None	0
130	Whiskey Creek	1	04/19/2011	3	1	0	0	0	0	0	0	0	None	0
130	Whiskey Creek	1	05/02/2011	4	1	0	0	0	0	0	0	0	None	0
130	Whiskey Creek	1	06/06/2011	5	1	0	0	0	0	0	0	0	None	0
130	Whiskey Creek	1	06/21/2011	6	1	0	0	0	0	0	0	0	None	0
131	McCoy Creek	1	05/11/2011	1	1	0	0	0	0	0	0	0	None	0
131	McCoy Creek	1	05/24/2011	2	1	0	0	0	0	0	0	0	None	0
131	McCoy Creek	1	06/06/2011	3	1	0	0	0	0	0	0	0	None	0

131	McCoy Creek	1	06/20/2011	4	1	0	0	0	0	0	0	0	None	0
132	Catherine Creek	1	03/23/2011	1	1	0	0	0	0	0	2	0	None	0
132	Catherine Creek	1	04/04/2011	2	1	0	0	0	0	0	0	0	None	0
132	Catherine Creek	1	04/28/2011	3	1	0	0	0	0	0	0	0	None	0
133	Mottet Creek	1	04/18/2011	1	1	0	0	0	0	0	0	0	None	0
133	Mottet Creek	1	05/25/2011	2	1	0	0	0	0	0	0	0	None	0
133	Mottet Creek	1	06/07/2011	3	1	0	0	0	0	0	0	0	None	0
133	Mottet Creek	1	06/22/2011	4	1	0	0	0	0	0	0	0	None	0
136	West Chicken Creek	1	03/15/2011	1	1	0	0	0	0	0	0	0	Few	0
136	West Chicken Creek	1	03/28/2011	2	1	0	0	0	0	0	0	0	Many	0
136	West Chicken Creek	1	04/14/2011	3	1	1	0	0	0	0	0	0	None	0
136	West Chicken Creek	1	04/28/2011	4	1	1	0	0	0	0	0	0	None	0
136	West Chicken Creek	1	05/09/2011	5	1	1	0	0	0	0	0	0	None	0
136	West Chicken Creek	1	05/23/2011	6	1	0	0	0	0	0	0	0	None	0
136	West Chicken Creek	1	06/08/2011	6	1	0	0	0	0	0	0	0	None	0
136	West Chicken Creek	1	06/21/2011	7	1	0	0	0	0	0	0	0	Many	0
138	Pelican Creek	1	04/28/2011	1	1	0	0	0	0	0	0	0	None	0
138	Pelican Creek	1	05/10/2011	2	1	0	0	0	0	0	0	0	None	0
138	Pelican Creek	1	06/02/2011	3	1	1	0	0	1	0	0	0	Few	0
138	Pelican Creek	1	06/13/2011	4	1	0	0	0	0	0	0	0	Few	0
138	Pelican Creek	1	06/28/2011	5	1	1	0	0	0	0	0	0	Few	0
139	Tybow Creek	1	03/15/2011	1	1	0	0	0	0	0	0	0	None	0
139	Tybow Creek	1	03/28/2011	2	1	1	0	0	1	0	0	0	Few	0
139	Tybow Creek	1	04/11/2011	3	1	0	0	0	0	0	0	0	None	0
139	Tybow Creek	1	04/27/2011	4	1	0	0	0	0	0	0	0	None	0
139	Tybow Creek	1	05/11/2011	5	1	0	0	0	0	0	0	0	None	0
139	Tybow Creek	1	05/31/2011	6	1	0	0	0	0	0	0	0	None	0
139	Tybow Creek	1	06/14/2011	7	1	0	0	0	0	0	0	0	None	0
140	Indian Creek	1	05/11/2011	1	1	0	0	0	0	0	0	0	Many	0
140	Indian Creek	1	06/14/2011	2	1	0	0	0	0	0	0	0	Few	0
141	Clark Creek	1	04/27/2011	1	1	0	0	0	0	0	0	0	None	0
141	Clark Creek	1	05/25/2011	2	1	0	0	0	0	0	0	0	None	0
141	Clark Creek	1	06/09/2011	3	1	0	0	0	0	0	0	0	None	0

Appendix II

Total redds, live steelhead, and dead steelhead observed on annual sites during spawning surveys March through June of 2008 – 2011.

		Live Fish Near Redd			Live Fish Not Near Redd			Dead Fish Near Redd			Dead Fish Not Near Redd		
Year	Total Redds	Ad Clip	No Ad Clip	Unknown	Ad Clip	No Ad Clip	Unknown	Ad Clip	No Ad Clip	Unknown	Ad Clip	No Ad Clip	Unknown
2008	10	0	5	0	0	1	1	0	0	0	0	0	0
2009	14	1	3	3	0	0	4	0	0	0	0	0	0
2010	50	1	3	3	0	7	1	0	0	0	0	0	0
2011	16	2	2	1	0	2	1	0	0	0	0	0	0

Total redds, live steelhead, and dead steelhead observed on all other sites not visited annually during spawning surveys March through June of 2008 – 2011.

		Live Fish Near Redd			Live Fish Not Near Redd			Dead Fish Near Redd			Dead Fish Not Near Redd		
Year	Total Redds	Ad Clip	No Ad Clip	Unknown	Ad Clip	No Ad Clip	Unknown	Ad Clip	No Ad Clip	Unknown	Ad Clip	No Ad Clip	Unknown
2008	14	0	0	2	0	1	4	0	0	0	0	0	0
2009	28	0	6	3	1	4	1	0	0	0	0	0	0
2010	59	0	4	5	0	8	2	0	0	0	0	0	0
2011	28	0	3	2	0	2	1	0	0	0	0	0	0