Lower Snake River Compensation Plan
Confederated Tribes of the Umatilla Indian Reservation
Evaluation Studies for 1 January to 31 December 2001

Section I
Evaluation of Reestablishing Natural Production of
Spring Chinook Salmon in Lookingglass Creek, Oregon,
Using a Non-Endemic Hatchery Stock

Section II
Oncorhynchus mykiss Investigations in Lookingglass Creek
and Other Grande Ronde River Tributaries

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Assistance Provided to LSRCP Cooperators and Other Projects

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SECTION I

Evaluation of Reestablishing Natural Production of Spring Chinook Salmon in Lookingglass Creek, Oregon, Using a Non-endemic Hatchery Stock

Abstract

We trapped 54 unmarked, 13 adipose-clipped only, and 510 adipose-right-ventral clipped spring Chinook salmon adults at Lookingglass Hatchery between 6 April and 4 October 2001. All were released below the weir to spawn naturally. No fish were intentionally passed above the weir. We completed 1 survey above the weir on 7 September 2001 and 8 surveys below the weir from 24 August to 21 September 2001. We observed no redds above the hatchery weir and 86 below the weir. We recovered 95 carcasses below the hatchery weir and none above the weir in 2001.

Progeny-per-parent ratio for the naturally-produced 1996 cohort from Lookingglass Creek was 1.41 while that of the adipose-only-clipped hatchery-produced 1996 cohort was 4.00. Ratios from other Grande Ronde River tributaries ranged from 0.92 to 3.99.

Movement of juveniles from the hatchery-produced 1999 cohort past the rotary screw trap in Lookingglass Creek peaked in July 2000 just after release and again in March of 2001, with smaller peaks in September of 2000. Total estimated number of juveniles passing the trap was 7,646.

The median monthly fork length of hatchery-produced fish captured in the trap ranged from 93 mm in July 2000 to 102 mm in May 2000.

We PIT-tagged three groups of fish from the hatchery-produced 1999 cohort from Lookingglass Creek to estimate survival and arrival timing to Lower Granite Dam. Three (seasonal) groups were tagged at the screw trap: June to September 1999 (fall), October to December 1999 (winter), and January to June 2000 (spring). The median arrival date at Lower Granite Dam for the fall and winter groups was 27 April 2001 while that of the spring group was 2 May 2001. Groups tagged later at the trap had higher minimum survival rates: 11.1 (fall), 30.9 (winter), and 54.1% (spring). Minimum survival rates for months with at least 50 fish PIT-tagged (June 2000 through April 2001) ranged from 6.8 to 60.0%.

Introduction

Anadromous salmonid stocks have declined in both the Grande Ronde River Basin (Lower Snake River Compensation Plan (LSRCP) Status Review Symposium 1998) and in the entire Snake River Basin (Nehlsen et al. 1991), many to the point of extinction. The Grande Ronde River Basin historically supported large populations of fall and spring Chinook (*Oncorhynchus tshawytscha*), sockeye (*O. nerka*), and coho (*O. kisutch*) salmon and steelhead trout (*O. mykiss*) (Nehlsen et al. 1991). The dwindling of Chinook salmon and steelhead populations and extirpation of coho and sockeye salmon in the Grande Ronde River Basin was, in part, a result of construction and operation of hydroelectric facilities, overfishing, and loss and degradation of critical spawning and rearing habitat in the Columbia and Snake River basins (Nehlsen et al. 1991).

Hatcheries were built in Oregon, Washington and Idaho under LSRCP to compensate for losses of anadromous salmonids due to the construction and operation of the lowest four Snake River dams. Lookingglass Hatchery (LH) on Lookingglass Creek, a tributary of the Grande Ronde River, was completed under LSRCP in 1982 and has served as the main incubation and rearing site for Chinook salmon programs for Grande Ronde and Imnaha rivers in Oregon. Despite these hatchery programs, natural spring Chinook populations continued to decline, resulting in the National Marine Fisheries Service (NMFS) listing Snake River spring/summer Chinook salmon as "threatened" under the federal Endangered Species Act (1973) on 22 April 1992.

This study was designed to evaluate the potential for reestablishing spring Chinook salmon natural production in Lookingglass Creek using a hatchery stock (Lofy et al. 1994). The Confederated Tribes of the Umatilla Indian Reservation (CTUIR) and the Oregon Department of Fish and Wildlife (ODFW) developed the study in consultation with the Nez Perce Tribe. Fishery managers believed that Lookingglass Creek was a good location to evaluate reintroduction of a non-endemic hatchery stock in the Grande Ronde River Basin. It was assumed that the relatively good quality habitat available in Lookingglass Creek would provide an adequate opportunity for success, and the existence of the weir at LH provided the ability to easily control and document adult escapement. There was also a database on the life history and success of the endemic (now extirpated) spring Chinook salmon in Lookingglass Creek from 1964 to 1974 (Burck 1993; Burck 1964-1974) that would aid in the evaluation of the relative success of an introduced stock.

Until this study was initiated in 1992, no adult spring Chinook salmon captured at the LH weir were placed upstream of the hatchery with the exception of a few fish in 1989. The upstream migration of spring Chinook salmon has been blocked by a picket or floating weir located at the hatchery. The weir has been fairly effective at preventing upstream migration. However, some fish escaped above the weir each year, as evidenced by redd counts during spawning surveys from 1982-1991 (ODFW, unpublished data).

From 1992 to 1994, adults were placed above the LH weir (Lofy and M^{c}Lean 1995a; Lofy and M^{c}Lean 1995b; and M^{c}Lean and Lofy 1995). In the fall of 1994, an infectious hematopoietic necrosis (IHN) epizootic at LH affected the 1993 cohort being reared at the hatchery. This incident created increased concern about the potential negative effects of supplementation above the hatchery weir with adult salmon increasing the pathogen prevalence in the LH water supply. Because of these concerns, the release of adults above the LH weir did not take place in 1995 (M^{c}Lean and Lofy 1998). Instead, CTUIR and co-managers retained the adults for artificial propagation and used the progeny of unmarked spring Chinook salmon that returned to LH in 1995 for supplementation as parr (i.e., artificial spawning/ incubation/ early rearing at LH and release in 1996 as parr above the weir on Lookingglass Creek) (McLean and Lofy 1998, 1999).

With continued concern about increasing pathogen prevalence in the water supply for LH, co-managers decided to release only 50 adults above the weir in 1996, fewer than the 100 to 300 fish released from 1992-1994 (McLean and Lofy 1999). As a condition of the release of adults above the weir in 1996, CTUIR personnel made an increased effort to recover carcasses and remove them from the active stream channel to reduce the number of carcasses in the water, which would presumably reduce the potential pathogen load in the water supply (Letter from William Stelle, NMFS, to Michael Spear, USFWS, 16 August, 1996; McLean and Lofy 1999). All remaining unmarked fish that were trapped at LH in 1996 (20 females and 21 males) were spawned at the hatchery. Their progeny were released as smolts from the hatchery at 42.1 fish-per-pound and 19.3 fish-per-pound in 1998 (McLean and Lofy 2000a).

In 1997, all returning unmarked fish (77) trapped at LH were released above the weir while keeping the survey frequency the same as in 1996 (McLean and Lofy 1999).

In 1998, and 1999 it was again decided by co-managers to not intentionally release adult spring Chinook salmon above the LH weir due to the potential increase in pathogen prevalence in the water supply. Returning spring Chinook salmon that were captured at the LH trap were retained at the hatchery in 1998 and 1999. These fish came from several sources: unmarked (most likely of natural parentage from Lookingglass Creek), adipose-only-clipped jacks (returns from our 1995 cohort release of progeny of unmarked adult spring Chinook salmon), and adipose-right ventral fin-clipped fish (returns from LH releases that were not intercepted at Lower Granite Dam) (McLean and Lofy 1999 and 2000). All spring Chinook salmon captured at LH were transported to the CTUIR South Fork Walla Walla Facility (SFWW) due to higher priority for holding space being given to programs for endemic broodstock that are held at LH. The unmarked and adipose-only-clipped jacks were spawned at SFWW and the eggs taken to Irrigon Hatchery for incubation. After hatching and marking, these fish were released into Lookingglass Creek in July 1999. Gametes of the adipose-right-ventral fin-clipped fish were taken at SFWW by the Nez Perce Tribe for the Rapid River stock program in Idaho.

In 2000 no fish were intentionally passed above the weir and no redds were observed above the weir. All returning fish to Lookingglass Creek were allowed to spawn below the weir or be harvested in tribal fisheries. The trap at LH was operated during the return and fish were enumerated and given an opercle punch to identify it as having been trapped. These fish were then trucked downstream 1 mile and released back into the stream for harvest opportunities. Similar activities were conducted in 2001 with the exception of a pre-smolt release of fish from Lookingglass Hatchery in September 2001. The fish were Catherine Creek stock juveniles that were surplus to the Catherine Creek supplementation program.

Study Area

The Lookingglass Creek basin is located in the Blue Mountains of northeast Oregon with the headwaters originating at an elevation of about 4,870 feet above sea level (Figure 1). Lookingglass Creek flows to the southeast approximately 15.5 river miles (rm) through the Umatilla National Forest then through private land where it enters the Grande Ronde River at approximately rm 85, at an elevation of about 2,355 feet above sea level. Lookingglass Creek has five major tributaries, Lost Creek (about rm 10.75), Summer Creek (about rm 10.25), Eagle Creek (about rm 8.25), Little Lookingglass Creek (just below rm 4.25), and Jarboe Creek (just below rm 2.25). Lookingglass Creek and Little Lookingglass Creek (the largest tributary) are the only major portions of the basin where adult spring Chinook salmon spawning takes place with any regularity. LH is located at about rm 2.50 on Lookingglass Creek. Burck (1993) divided these two streams into four geographic units for evaluation of spring Chinook salmon production (Figure 2). We used these same units and landmarks in our study, but we further divided unit 3 into upper and lower sections. The lower portion of unit 3 is entirely privately owned. In 2001 the landowner allowed access to his portion of Lookingglass Creek for spawning ground surveys.

Methods

Stream Flow and Temperature

We obtained and summarized 2001 stream flow data collected by the United States Geological Survey (USGS) for comparison to stream flows recorded in Lookingglass Creek from 1964 to 1971 (at about rm 2.50) (Burck 1993) (Figure 3). Mean daily stream flows (0.5-hour sample interval) in Lookingglass Creek for 2000 were estimated from an electronic stream gauging station located just below the floating weir (personal communication, Jo Miller, USGS, Walla Walla District, WA). Maximum and minimum daily mean flows for each week of the year were reported here using methods described in M^{c}Lean and Lofy (1995).

Stream temperature data were collected for comparison to stream temperatures recorded in Lookingglass Creek from 1964 to 1971 at rm 4.25 by Burck (1993) (Figure 3). The daily range of hourly stream temperatures for 2001 were obtained from summaries completed by the United States Forest Service (USFS)(personal communication Darlene Robison, USFS, Umatilla National Forest, Pendleton, OR) and from an electronic thermograph (Ryan Tempmentor®2000) operated by CTUIR. Stream temperature data collected in 2001 were recorded by USFS at the forest service boundary (at about rm 7.25) and by CTUIR in the screw trap livebox 0.25 rm above the mouth. We summarized all hourly stream temperature data as a weekly range (M^{c}Lean and Lofy 1995).

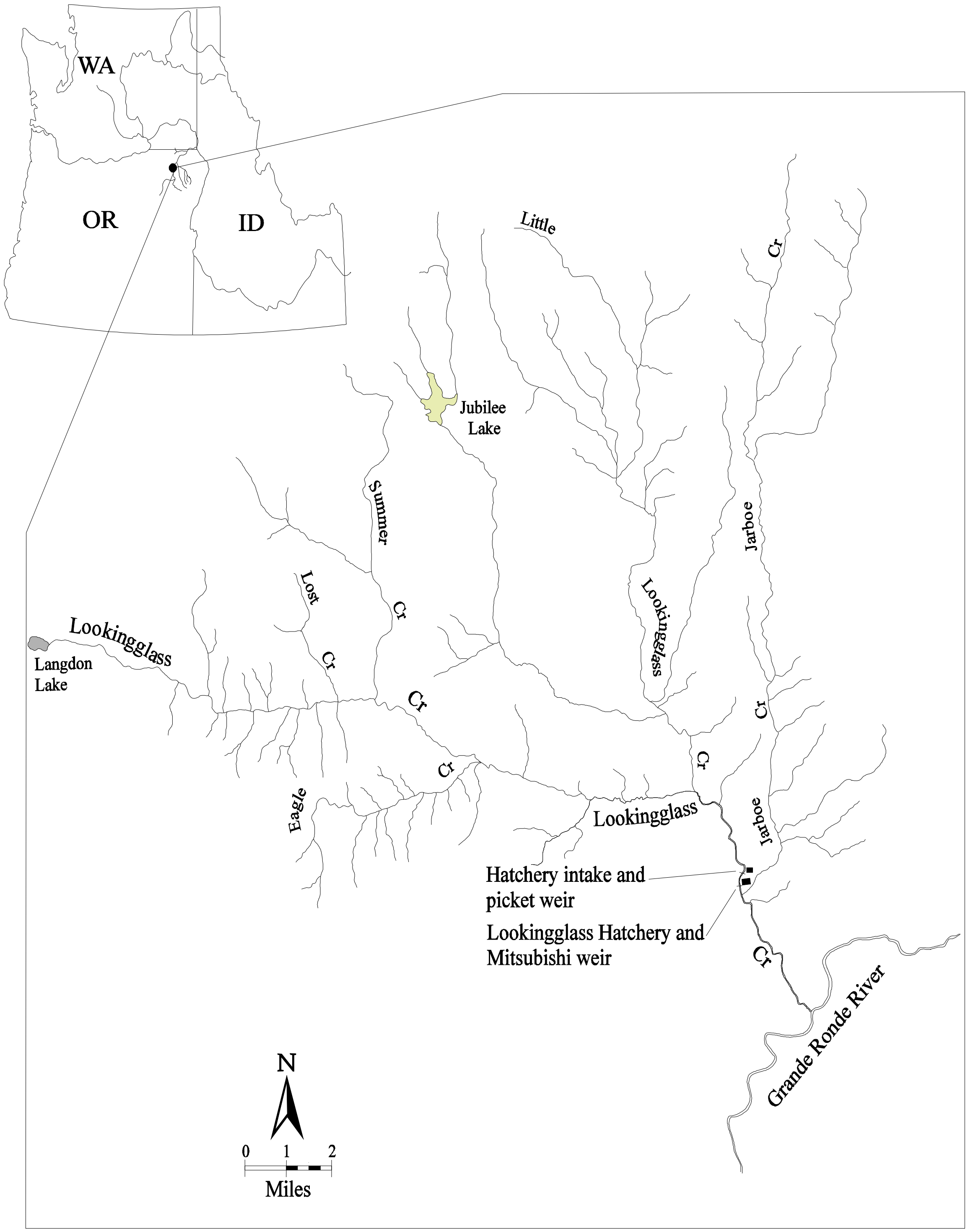

Figure 1. Map of the Lookingglass Creek basin showing the location of major tributaries and the Lookingglass Hatchery complex.

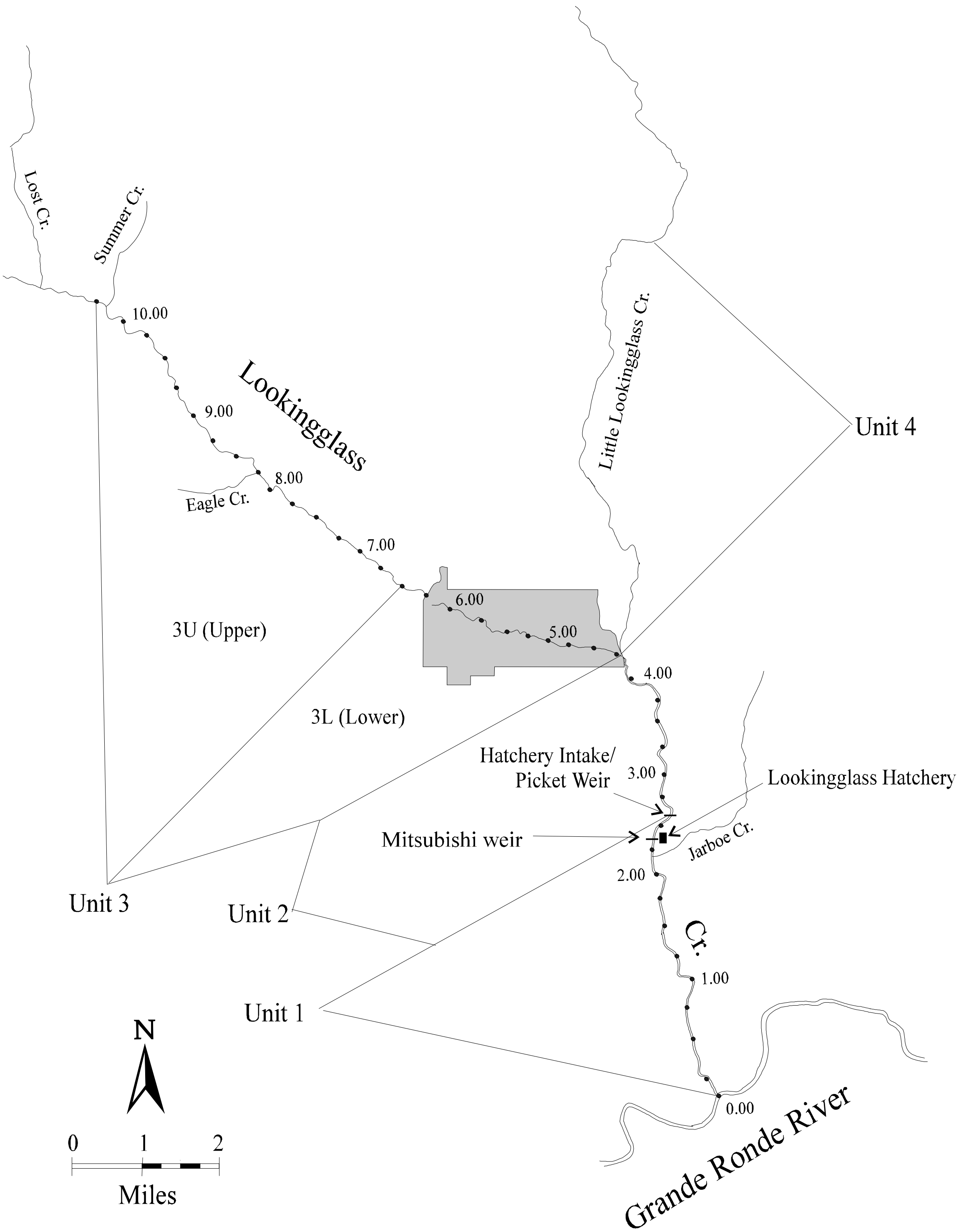

Figure 2. Unit Designations and 0.25-river mile sections of Lookingglass Creek. The shaded area is the private property where access by the landowner was limited only to spawning ground surveys in 2001.

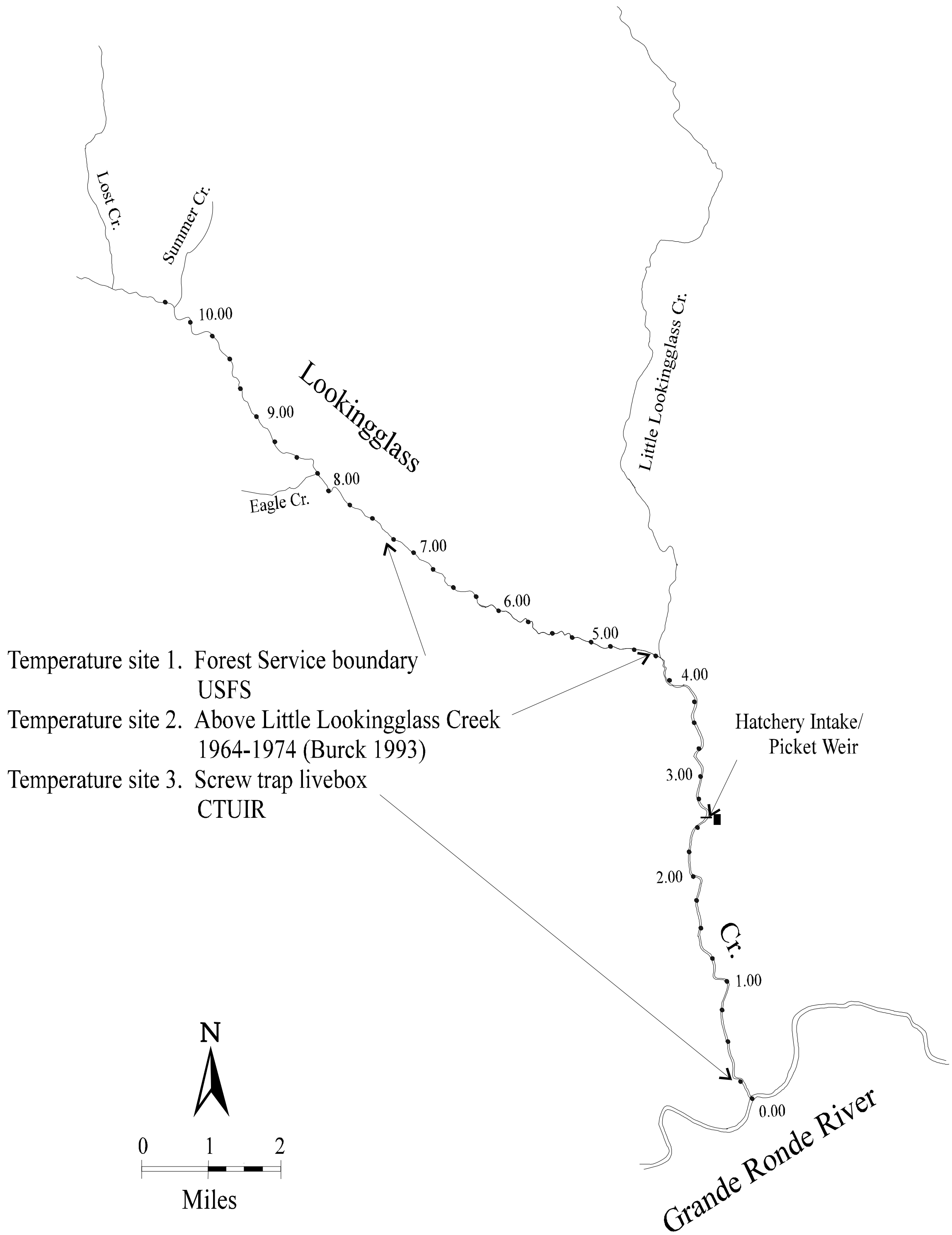

Figure 3. Location of temperature data recorders in Lookingglass Creek in 2001.

Adult Returns to Lookingglass Hatchery

Unmarked and marked adult spring Chinook salmon returning to Lookingglass Creek were enumerated by CTUIR. Returning fish were diverted into a hatchery trap using a picket weir (upper weir), which was installed on 6 April 2001. The trap was checked up to three times a week for the duration of the return to Lookingglass Creek (until spawning was completed in Lookingglass Creek). The picket weir was removed on 4 October 2001.

All fish captured in the trap were checked for fin clips, measured for fork length (mm), opercle punched for recapture information, then released below the trap. We took scale samples from unmarked and adipose-only-clipped salmon for age determination. Fish captured in the trap that had an opercle punch were noted and released again below the trap. All fish were transported in a fish tank below the weir to rm 1.0 to be released for a tribal fishery. The median length of captured fish was used to describe the population because the median is not sensitive to extreme values which can skew the mean.

Adult spring Chinook salmon returns to Lookingglass Creek consisted of progeny of natural fish which were not marked (1996-1997 cohorts); progeny of unmarked parents hatched and partially reared (1998 cohort, July presmolt release) and reared to smolt (1996 cohort, April release) in the hatchery which were adipose-clipped only (ad-only); and progeny of marked fish hatched and reared in the hatchery for an April smolt release (1996-1997 cohorts of Rapid River stock) which were adipose and right ventral fin-clipped (ADRV).

In 2001, all fish that were not harvested in the tribal fisheries, were allowed to spawn naturally in the 2.50 rm section below the hatchery trap. No fish were intentionally released above the hatchery weir for natural production in 2001.

Spawning Ground Surveys

In 2001, we conducted spawning ground surveys in Unit 1 of Lookingglass Creek on 8 different days to count redds and recover carcasses (Figure 2). We surveyed Units 3U, 3L, 2, and Unit 4 (Little Lookingglass) only once. An index survey was completed on 7 September 2001 for the ODFW spring Chinook salmon spawning ground index count for Lookingglass Creek. In 2001, we were given permission to survey Unit 3L (private property), which in the past has not been given. Fewer surveys were completed above the weir than below because no fish were intentionally released above the weir and we were confident that most of the fish attempting to migrate above the weir were stopped. Surveys were conducted in Unit 1 every 3 to 5 days after the first redds were observed (24 August 2001), to count redds and recover spawned-out adult spring Chinook salmon. We collected carcasses, and weak-swimming fish to document all spring Chinook salmon that returned to Lookingglass Creek and recover the coded-wire tags (CWT) from the snouts of some fish. Determination of whether or not a fish should be gaffed and killed was made by visual inspection of the females (flaccid abdomen and tail erosion was interpreted as a spawned fish), and length of time the females had been observed on a redd. For males we used their ability to swim or escape capture (if they were easily approached and captured by hand), or if there were surplus males available (most of the females had finished spawning). If there was any question that the fish may not be finished spawning it was not gaffed. During surveys, only completed redds were counted (McLean and Lofy 1995).

Population Estimation

We used marked (opercle punched at the trap) and unmarked (no opercle punch) carcasses collected to estimate the total population of adult spring Chinook salmon in Lookingglass Creek. We expanded each fin-clip group population based on a marked to unmarked ratio of carcasses recovered (McLean and Lofy 1995).

Progeny-per-Parent Estimation

In order to evaluate the relative success of the smolt release in 1996 (McLean and Lofy 2000) and the spawning that occurred above the weir in 1996, the progeny-per-parent ratio was calculated using the adipose-clipped and unmarked adult spring Chinook salmon intercepted at LH and recovered above and below the weir during spawning ground surveys in 1999, 2000, and 2001. The fish were enumerated and aged using scales to determine cohort year.

The progeny-per-parent ratio was calculated using the number of adipose-clipped and unmarked fish recovered in Lookingglass Creek from 1999-2001 divided by the number of adults spawned at the hatchery and in the wild in 1996 (McLean and Lofy 1999). Progeny-per-parent ratios of other Grande Ronde River basin tributaries were calculated for comparison to Lookingglass Creek. Because there were no weirs or actual counts of adult returns escaping to any other Grande Ronde River basin tributaries, expanded redd counts in each of these tributaries were multiplied by the average fish-per-redd estimate of 3.26 to obtain an estimate of adult escapement (Appendix Tables A-1 to A-5)(McLean and Lofy 2001). Spawning ground surveys completed in the Grande Ronde River basin usually consisted of an index count (covering all sections) followed by two supplemental counts (covering an index area where most of the spawning occurs but not always every section of the stream). The age structure for a tributary was based on scales from spring Chinook salmon carcasses recovered on spawning grounds on a return year basis throughout the Grande Ronde River basin (Appendix Table A-6). Cohort proportions within a run year were applied to all natural populations to estimate the number of fish from each cohort within each return year (ODFW, unpublished data; McLean and Lofy 2001). No adjustment was made for differences in recoverability of different aged fish.

Redd counts for each tributary from 1999-2001 were expanded in order to account for times or places where multiple surveys were not completed. We expanded tributary redds each year by using the average (1986-2001) percentage of redds by section, which was calculated using the total number of redds counted on the last date that all sections were surveyed for each year (McLean and Lofy 2001). The average percentage for each section was then applied each year to sections where the redd counts were not complete (not surveyed on the final survey of the year)(McLean and Lofy 2001). If the expanded number of redds in a section was less than the actual number of redds counted in that section the actual number was used in the total expanded redd estimation (McLean and Lofy 2001). This method assumes that the distribution of redds at the end of spawning is similar to that on the last date a comprehensive count was completed.

Genetic Monitoring

As part of an ongoing genetic monitoring program, NMFS requested that we collect a tissue sample (opercle punch) for genetic analysis from unmarked and marked adult spring Chinook salmon that returned to LH. After the tissue samples were collected, they were immediately placed in vials and fixed with ethanol. The tissue is being retained at our research office in La Grande, Oregon, until funding can be acquired to analyze the samples.

Population Estimates of the Hatchery-produced 1999 Cohort Using a Screw Trap

To evaluate the survival of hatchery-produced juvenile spring Chinook salmon from the 1999 cohort (released as presmolts in June 2000) and enumerate natural production above and below the weir, we operated a screw trap at rm 0.25 of Lookingglass Creek. No redds were observed above the weir in 2001. We captured fish to estimate migration timing to the trap and total number of fish moving past the trap site. From June 2001 to December 2001, we also captured fish from both the naturally and hatchery-produced 2000 cohort. Differences in fork length ranges made it possible to differentiate the two cohorts.

Most juvenile spring Chinook salmon captured in our rotary screw trap were measured (fork length, mm), weighed (g) and enumerated similar to McLean and Lofy (1998). At times, we just counted fish because they appeared injured or there were more fish in the trap than was necessary for the minimum sample size of 50 (we subsampled this group). Occasionally, small fry that were dipped out of the trap box were presumed to have been eaten when they were not observed later in the bucket.

We expanded the number of fish captured each month using trap efficiency estimates (McLean and Lofy 1998). All months were totaled to obtain the overall population estimate of fish moving past the trap. We used PIT tags as marks for estimating the trapping efficiency of the hatchery-produced 1999 cohort in order to track individual fish and increase our sample size of PIT-tagged fish for mainstem dam detections. Every healthy juvenile spring Chinook salmon captured at the trap that was at least 60 mm in fork length was tagged and marked with Alcian blue dye, then released above the trap efficiency estimation. For smaller fish that could not be PIT-tagged (<60 mm) we used only a mark of Alcian blue dye. We used a secondary mark of Alcian blue dye (applied with a battery operated tattoo pen on the caudal peduncle of the trap efficiency fish) so we could recognize fish released for trap efficiency and refrain from using them for trap efficiency multiple times. To calculate the variance around the estimate of total migration and the estimated numbers of fish trapped each month for the hatchery-produced 1999 cohort, we used a bootstrap method (McLean and Lofy 1998).

Monthly Fork Length Sampling of the Hatchery-produced 1999 Cohort

We conducted monthly fork length sampling of hatchery-produced spring Chinook salmon from the 1999 cohort to monitor growth patterns of fish passing the screw trap. We attempted to measure fork lengths from about 50 juvenile spring Chinook salmon at the screw trap around the 20th of the month (±5 days) (McLean and Lofy 1998). The median length was used to describe the population because the median is not sensitive to extreme values which can skew the mean. We were unable to capture a large sample size of hatchery-produced fish from the trap in some months.

PIT-tagging of the Hatchery-produced 1999 Cohort

Three groups of juvenile spring Chinook salmon from the hatchery-produced 1999 cohort were PIT-tagged to determine arrival timing at and the minimum survival rate to Lower Granite Dam. These groups were categorized by initial arrival timing at the screw trap (Burck 1993). The "Fall group" was PIT-tagged from 30 June-30 September 2000. The "Winter group" was tagged from

1 October-31 December 2000. The "Spring group" was tagged from 1 January-30 May 2001: the date on which the last non-precocial juvenile from the hatchery-produced 1999 cohort was captured in the screw trap (M^cLean and Lofy 1998).

Weekly Arrival Timing and Minimum Survival to Lower Granite Dam

We used weekly arrival timing and minimum survival rate to Lower Granite Dam of the three groups of PIT-tagged fish from Lookingglass Creek, as well as PIT-tagged fish from other natural populations in the Grande Ronde River basin from the 1999 cohort (tagged by ODFW in 2000) to describe outmigration timing and determine if a trend in survival was evident over time.

For arrival timing of the trap groups, the daily detections were expanded for spill using a daily expansion factor [(Powerhouse Flow + Spillway Flow) / Powerhouse Flow](United States Army Corp of Engineers (USACE) River Information). Arrival timing at Lower Granite Dam for each group was graphed using the expanded weekly detections as a percentage of the total expanded number of fish for that group.

To determine minimum survival rate of the trap groups to Lower Granite Dam, the total unique detections at all Snake and Columbia River dams were used. Survival rates were calculated for tagged fish by dividing the total number of unique detections by the total number of the juveniles tagged during that month or for that group.

Results/Discussion

Stream Flow and Temperature

Increasing flows did not begin in Lookingglass Creek until the week of 18 March in 2001 (Figure 4). Weekly maximum flows ranged from 1-13 m^3/s with sustained high flows from the week of 29 April to the week of 20 May. After the highest flows the week of 20 May, flow decreased dramatically to a summer low of about 1-2 m^3/s after the week of 24 June and never increasing in the fall. Maximum flows in 2001 were well below the maximum flows seen historically from 1964 to 1971 for the same weeks.

Water temperature peaked at Site 1 (rm 7.25) during the week of 9 July (14.0^{o}C) and at Site 3 (screw trap livebox) in Lookingglass Creek during the week of 9 July (20.0 ^{o}C) (Figure 4). Maximum temperatures for 2001 at Site3 were generally similar to those from 1964 to 1971 peaking at the same time 1-2 ^{o}C higher. Minimum water temperatures for all sites in 2001 were similar, generally falling within the minimums observed from 1964 to 1971.

Adult Returns to Lookingglass Hatchery

We trapped 54 unmarked adult spring Chinook salmon at LH in 2001: 1 three-year-old, 40 four-year-olds, 13 five-year-olds (Table 1). We trapped 13 fish that were ad-only: 2 three-year-olds, 4 four-year-olds, 7 five-year-olds, and 510 fish that were ADRV (fish were not aged).

Run timing for the three groups were very similar (Figure 5). We trapped 54-74% of the total for each group from 13 May to 10 June. There were 4 peaks in the number of recaptures at the trap: 3 June, 24 June, 15 July, and 26 August.

Spawning Ground Surveys

We conducted only one spawning ground survey of Units 3U, 3L, 4, 2 on 7 September 2001 (Figure 2). There were no redds observed in these units above the weir. We surveyed Unit 1 eight times from 24 August to 21 September 2001 and observed 86 completed redds. We observed 72 redds from the hatchery picket weir down to rm 1.75 which was 83.7% of the total redds observed. In this section, redds were grouped in areas where there was adequate spawning gravel. This grouping of redds led to overlapping of redds, which may have caused us to miss newer redds. Because of the overlapping, however, the number of redds that actually produced offspring may be closer to the number counted.

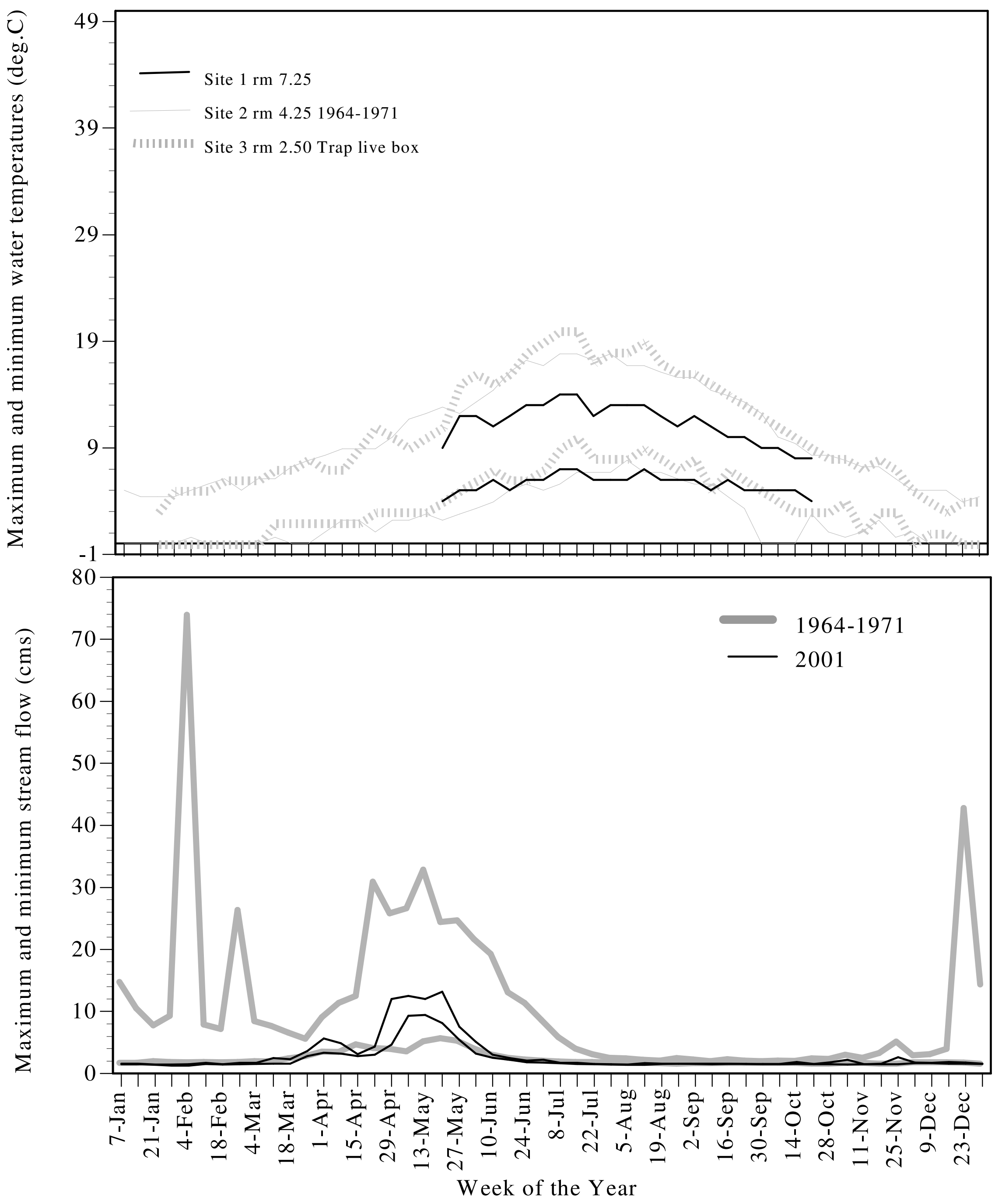

Figure 4. Historical (1964-1971) and 2001 ranges of weekly stream temperature and flow in Lookingglass Creek. Week of the year is represented by the last day of the week. Data for temperatures were provided by the USFS unpublished and Burck 1993. Data for flows were provided by USGS unpublished and Burck (1964-1974).

Table 1. Age, sex, and fork length data from spring Chinook salmon that were trapped at Lookingglass Hatchery and recovered below the hatchery weir in 2001.

Group, Disposition[b]	Age[c]	Males[a] Fork length (mm) N	Range	Median	Females[a] Fork length (mm) N	Range	Median
Unmarked,							
Trapped							
	3	1	567	--	--	--	--
	4	15	690-806	755	25	699-785	737
	5	8	823-902	856	5	800-924	860
Recovered opercle punched							
			2			4	
Recovered non-opercle punched							
	3	--	--	--	--	--	--
	4	1	790	--	4	740-780	754
	5	2	920-1013	966	--	--	--
Adipose-only clipped,							
Trapped							
	3	2	403-509	456	--	--	--
	4	2	800-810	805	2	740-774	757
	5	5	838-904	873	2	820-899	860
The 3-year-old fish, which Catherine Creek stock, were sacrificed for the CWT. One 4-year-old male was sacrificed for the carcass study							
Recovered opercle punched							
	3	--	--	--	--	--	--
	4	--	--	--	2	730	--
	5	--	--	--	--	--	--
Recovered non-opercle punched							
	3	--	--	--	--	--	--
	4	--	--	--	--	--	--
	5	1	890	--	1	815	--

Table 1 (cont.). Age, sex, and fork length data from spring Chinook salmon that were trapped at Lookingglass Hatchery and recovered below the hatchery weir in 2001.

		Males[a]			Females[a]		
Group,			Fork length (mm)			Fork length (mm)	
Disposition[b]	Age[c]	N	Range	Median	N	Range	Median
Adipose-right-ventral clipped,							
Trapped							
		220			229		
Sixty-one fish were sacrificed at trapping for a carcass study.							
Recovered opercle punched							
		12			24		
Recovered non-opercle punched							
		11			34		

[a] *The sex of the recovered fish was determined by internal inspection.*

[b] *Disposition of the fish, Trapped = captured at the hatchery trap, Recovered opercle punched = fish previously trapped that was found during spawning ground surveys, Recovered non-opercle punched = fish not previously trapped that was found during spawning ground surveys.*

[c] *Age of the fish was determined by CTUIR using scale reading.*

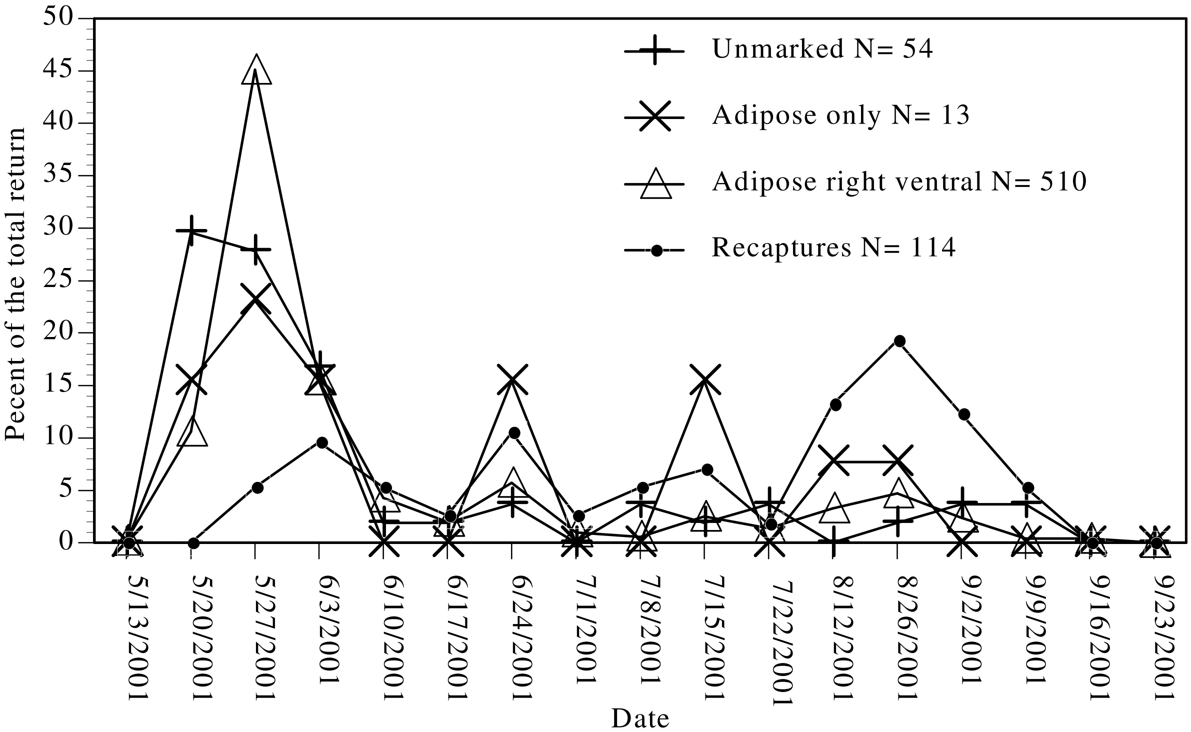

Figure 5. Arrival timing of progeny of marked (ADRV) and unmarked (AD only and no clip) adult spring Chinook salmon at the Lookingglass Hatchery adult trap in 2001. The weir was installed and opened on 6 April 2001, and closed on 4 October 2001.

We recovered 98 spring Chinook salmon carcasses during our surveys of Unit 1: 13 unmarked, 4 ad-only, and 81 ADRV, of which 44 had already been trapped at the picket weir (an opercle punch was evident)(Table 1). We recovered 69 female carcasses, all of which were completely spawned out.

Population Estimation

Using a marked to unmarked ratio of carcass recoveries, we estimated the unmarked spring Chinook salmon population below the weir on Lookingglass Creek to be 117 (Table 2). We estimated the ad-only group to be 20 and the ADRV group to be 808.

Progeny-per-Parent Estimation

The Lookingglass Creek progeny-per-parent ratio for the completed (ages 3-5) 1996 cohort for naturally-produced fish was 1.41 and for the hatchery-produced fish (AD) was 4.00 (Table 3). The 1996 cohort in other Grande Ronde River tributaries ranged from 0.92 to 3.99.

Table 2. Adult spring Chinook salmon population estimates (McLean and Lofy 1995) below the Lookingglass Hatchery weir.

Group Number marked and Released	Total carcass recovery	Total marked carcass recovery	Population estimate	SEM
Unmarked				
54	13	6	117	33.05
Adipose-clipped only				
10	4	2	20	8.94
Adipose-right-ventral clipped				
449	81	45	808	76.19

Table 3. Progeny-per-parent ratios for the 1996 cohort spring Chinook salmon returning to Lookingglass Creek or other Grande Ronde River tributaries, 1999-2001.

Cohort Location	Expanded redd count[a]	Parent Population[a]	Returning progeny by age[b] 3	4	5	Progeny-per-Parent
1996						
Lookingglass Cr. Nat.	24	50	5	51	15	1.41
Lookingglass Cr. AD.	71,038	41	17	137	10	4.00
Grande Ronde R.	25	82	0	60	15	0.92
Catherine Cr.	18	59	3	103	130	3.99
Lostine R.	27	88	4	193	128	3.70
Minam R.	122	397	5	615	230	2.14
Wenaha R.	133	432	2	417	258	1.57

a *Table is a summary of Appendix Tables A1-A5 (ODFW Research, La Grande, unpublished data) and data from McLean and Lofy (2001). Lookingglass fish were adipose-clipped and were released as smolts in Lookingglass Creek (71,038).*

b *Age structure from Appendix Table A6 was used to calculate the returning progeny from each cohort (ODFW Research, La Grande, unpublished data).*

Genetic Monitoring

We collected fin tissue for genetic analysis by NMFS. Tissue samples were collected from 12 ad-only and 60 unmarked spring Chinook salmon at the time of trapping at LH and during spawning ground surveys on Lookingglass Creek. The samples were placed in vials and preserved with ethanol. The vials are being archived at our office in La Grande, Oregon, until funding can be obtained for analysis.

Population Estimates of the Hatchery-produced 1999 Cohort Using a Screw Trap

We captured 1,630 (7,646 expanded) hatchery-produced juvenile spring Chinook salmon from the 1999 cohort in the rotary screw trap through June 2001 (Table 4). We released the hatchery-produced 1999 cohort on 29 June 2000, with the first fish captured at the rotary screw trap on 30 June 2000 and the last on 30 May 2001.

Of the fish estimated to have passed the trap site, 53.1% of the juveniles from the hatchery-produced 1999 cohort migrated before January 2001 as sub-yearlings (Figure 6). Peak migration past the trap occurred just after release in July with a secondary peak in migration in March 2001 (Figure 6).

Monthly Fork Length Sampling of the Hatchery-produced 1999 Cohort

We recorded fork length data from hatchery-produced spring Chinook salmon captured in the trap from July 2000 to April 2001. Median monthly fork lengths of captured hatchery-produced fish around the 20th of each month ranged from 93 mm in July 2000 to 102 mm in May 2001 (Figure 7).

PIT-tagging of the Hatchery-produced 1999 Cohort

We PIT-tagged a total of 548 juveniles from the Fall group, 149 juveniles from the Winter group, and 915 juveniles from the Spring group of hatchery-produced 1999 cohort at the screw trap (Table 5).

Weekly Arrival Timing and Minimum Survival to Lower Granite Dam

Juvenile Chinook salmon from the hatchery-produced 1999 cohort PIT-tagged at the screw trap first arrived (Fall and Winter groups) at Lower Granite Dam the week of 8 April 2001, with the last fish (Spring group) arriving the week of 17 June 2001 (Figure 8). Arrival distributions of the Fall and Winter groups appeared similar with median dates of arrival being 27 April 2001 (Table 5). Median arrival of the spring group was later at 2 May 2001 (Table 5). There was no spill at Lower Granite Dam during the outmigration so there was no expansion needed for spill.

Table 4. Hatchery-produced juvenile spring Chinook salmon from the 1999 cohort captured in a rotary screw trap, releases and recaptures from trap efficiency tests, and the estimated number of migrants from Lookingglass Creek during 2000 and 2001.

Month	Total trapped	Trap efficiency release	Trap efficiency recapture	% Trap efficiency[a]	Population Estimate
Jul	348	348	51	14.66	2,375
Aug	21	20	1	**21.61**	97
Sep	179	179	42	**21.61**	828
Oct	59	58	9	15.52	380
Nov	58	58	16	27.59	210
Dec	32	32	6	18.75	171
Jan	13	13	2	**23.91**	54
Feb	34	33	9	**23.91**	142
Mar	606	590	168	28.47	2,128
Apr	276	275	62	**22.22**	1,242
May	4	4	0	**22.22**	18
Totals	1,630	1,610	366		7,646

Number of hatchery-produced fish released into Lookingglass Creek: 24,201

[a] *Because the trap efficiency release was less than 25 fish for the months of August 2000, January 2001, and May 2001, the releases were combined with September(August, September), February (January, February), and April (April, May) to make one trap efficiency estimate that was used for each individual month.*

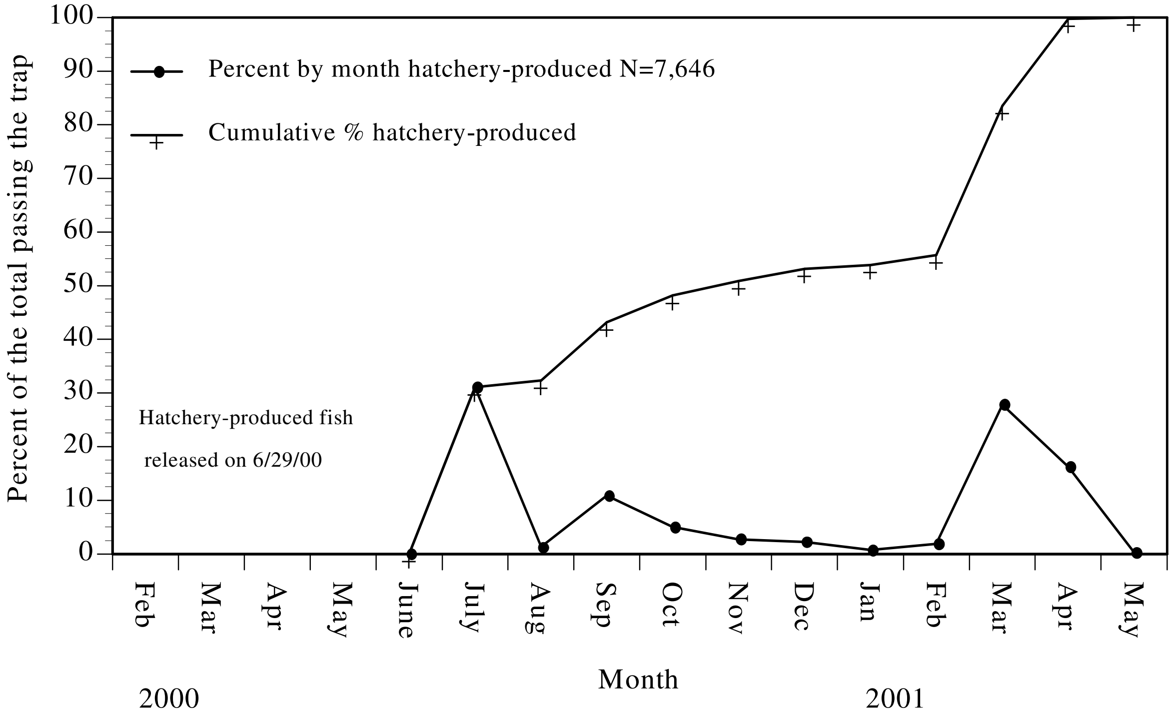

Figure 6. Percent of the total expanded numbers of hatchery-produced 1999 cohort juvenile spring Chinook salmon passing the rotary screw trap site on Lookingglass Creek, 2000 and 2001. Total estimated population (N) passing the trap is an expanded number.

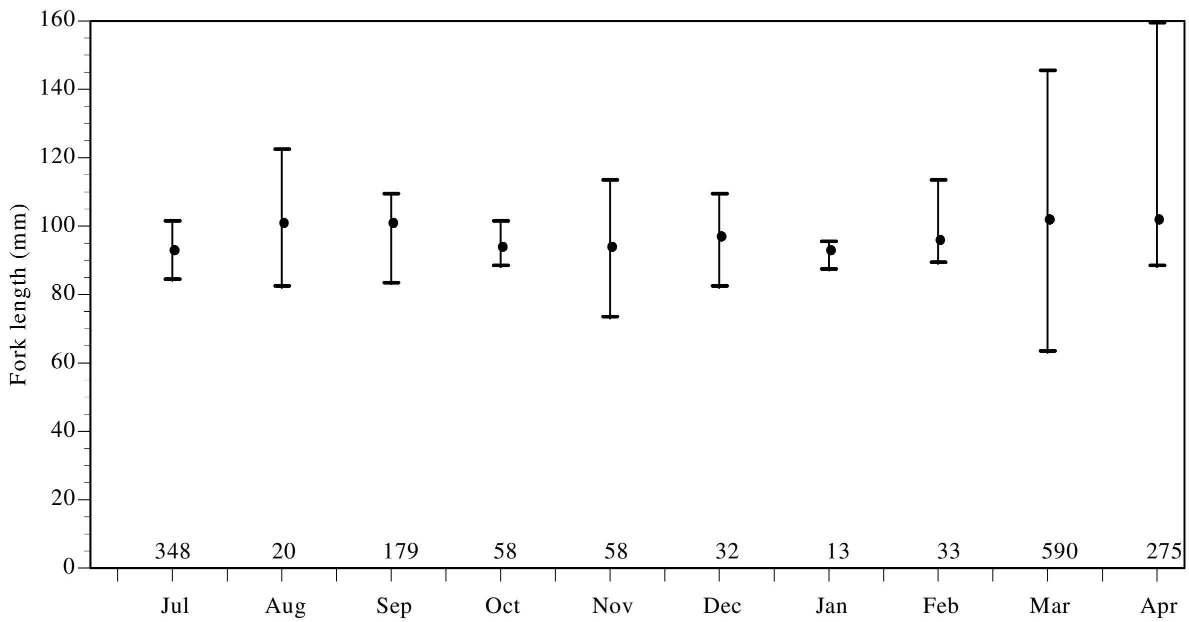

Figure 7. Monthly median and range of fork lengths from hatchery-produced 1999 cohort juvenile spring Chinook salmon captured in the rotary screw trap, 2000 and 2001. Length information from fish trapped around the 20th of each month (±5 days) was used. Sample size for each group is shown above the month.

Table 5. PIT tag information for hatchery-produced juvenile spring Chinook salmon from the hatchery-produced 1999 cohort captured at the rotary screw trap in Lookingglass Creek, 2000 and 2001.

	Lookingglass Cr.		Lower Granite Dam			Mainstem dams
Group	Number PIT-tagged	Tagging median date	Median arrival	Actual	Expanded[a]	total
Fall (trap)	548	10 July 2000	27 April 2001	47	47	51
Winter (trap)	149	13 September 2000	27 April 2001	38	38	46
Spring (trap)	915	23 March 2001	2 May 2001	407	407	495

[a] *Expansion factors may differ depending upon timing of individual fish.*

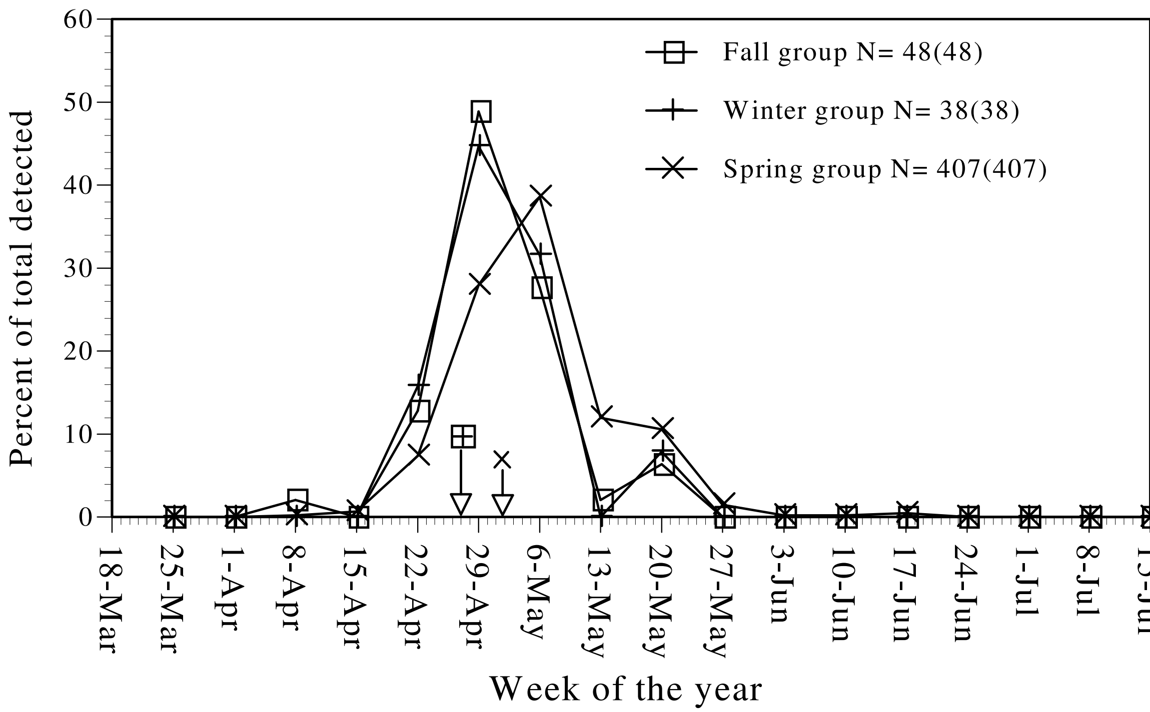

Figure 8. Arrival timing, by week, at Lower Granite Dam in 2001 of three groups of hatchery-produced 1999 cohort juvenile spring Chinook salmon PIT-tagged at the rotary screw trap in Lookingglass Creek. Arrows indicate median arrival date of each group. Expanded detections (N) are graphed. Actual detections are in parentheses. Week of the year is represented by the last date in the week.

Minimum survival rates of PIT-tagged juvenile spring Chinook salmon from the hatchery-produced 1999 cohort for the fall, winter, and spring groups were 11.1, 30.9, and 54.1%, respectively (Figure 9). Survival indices of the 1999 cohort captured at the trap and in the field by month for the months in which more than 50 tagged fish were released (June and July, September to November 2000, March and April 2001), ranged from 6.8 to 60.0%.

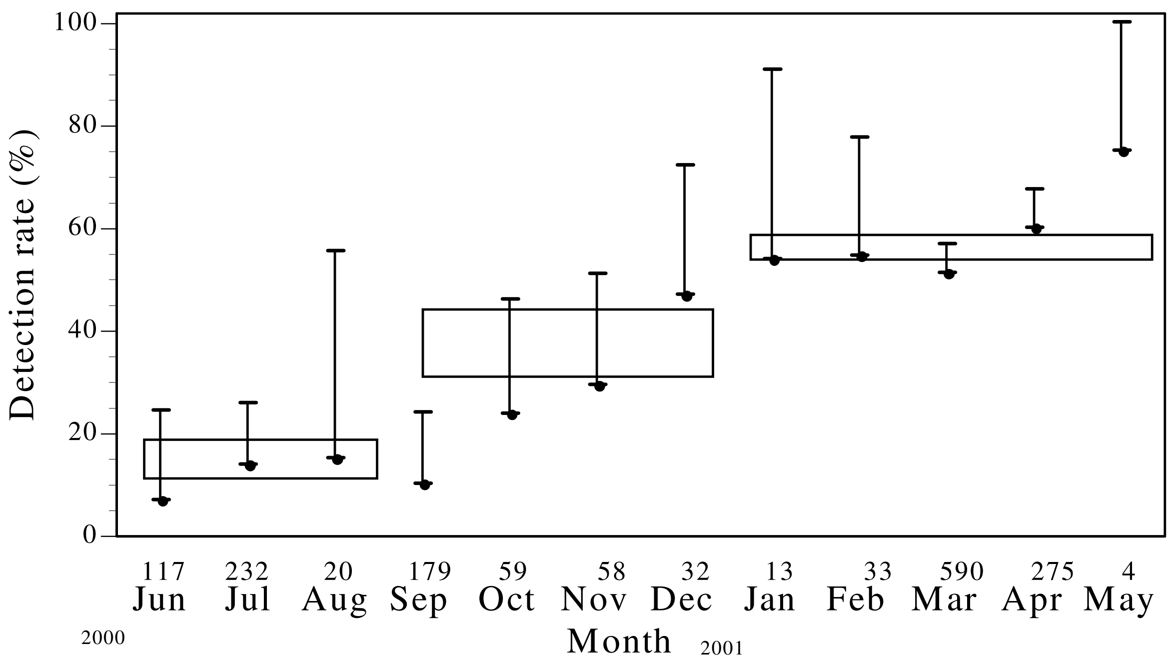

Figure 9. Total unique detection rates with upper 95% confidence intervals (bars) for hatchery-produced 1999 cohort juvenile spring Chinook salmon tagged at the rotary screw trap in Lookingglass Creek and detected at Snake or Columbia river dams. The rectangles represent detection rates and upper 95% confidence intervals for fish from Fall (Jun-Sep), Winter (Oct-Dec), and Spring (Jan-Apr) groups. Number tagged is above each month.

SECTION 2

Oncorhynchus mykiss Investigations in Lookingglass Creek and Other Grande Ronde River Tributaries

Abstract

We trapped 114 adult summer steelhead at the LH trap between 6 April and 4 October 2001. All of these fish were released above the weir to spawn naturally.

In 2001 co-managers sampled between 55 and 100 juvenile *O. mykiss* from the sample stream in each unit of the Grande Ronde and Imnaha River basins used to index the genetic makeup of *O. mykiss* within each unit. The size range of the fish collected was from 19 to 87 mm fork length.

In 2001 we captured 2,509 juvenile *O. mykiss* in the rotary screw trap on Lookingglass Creek. The number estimated to have passed the trap in 2001 was 39,052 based on trap efficiency estimates. There are two main peaks of movement past the trap, most migrate during the spring while a secondary peak occurs in the fall. The spring movement of the smaller fish (<30-109mm) generally peaked 1 to 2 months later than the spring movement of the larger fish (110-189mm, and 190- >249mm). Most (58.4%) of the fish captured in the trap were from the medium size group (110-189mm), while only 34.4% and 7.2% were from the small (<30-109mm) and large groups (190- >249mm) respectively.

We PIT-tagged 2,200 juvenile *O. mykiss* at the rotary screw trap in 2001. The data from these PIT-tagged fish will be summarized in 2003 when the outmigration is complete.

Introduction

The Grande Ronde River Basin historically supported large populations of fall and spring Chinook (*Oncorhynchus tshawytscha*), sockeye (*O. nerka*) and coho (*O. kisutch*) salmon and steelhead trout (*O. mykiss*) (Nehlsen et al. 1991). The decline of Chinook salmon and steelhead populations and extirpation of coho and sockeye salmon in the Grande Ronde River Basin was, in part, a result of construction and operation of hydroelectric facilities, overfishing, and loss and degradation of critical spawning and rearing habitat in the Columbia and Snake river basins (Nehlsen et al. 1991). Anadromous salmonid stocks have declined in both the Grande Ronde River Basin (Lower Snake River Compensation Plan (LSRCP) Status Review Symposium 1998) and in the entire Snake River Basin (Nehlsen et al. 1991), many to the point of extinction.

Hatcheries were built in Oregon, Washington and Idaho under the LSRCP to compensate for losses of summer steelhead due to the construction and operation of the lowest four Snake River dams. Despite these harvest-driven hatchery programs, natural summer steelhead populations continued to decline as evidenced by declining counts at Lower Granite Dam since 1995 (Columbia River Data Access in Real Time, DART) and low steelhead redd counts on index streams in the Grande Ronde Basin (Oregon Department of Fish and Wildlife, District Annual Reports 1949-1998). There has also been a high hatchery-to-natural ratio in the creel surveys since 1991 (Flesher et. al. 1991 and Flesher et. al. 1992-1999) and of fish trapped in Grande Ronde River tributaries, Five Point Creek (personal communication Paul Sankovich, ODFW Research) in 1998 and Lookingglass creek in 1997. Because of low escapement the Snake River summer steelhead were listed as threatened under the Endangered Species Act of 1973 by the National Marine Fisheries Service (NMFS) on 18 August, 1997. Co-managers have also discontinued off-station releases of juvenile Wallowa stock (non-endemic) hatchery summer steelhead into Catherine Creek in 1998 and the upper Grande Ronde River in 1999.

Data are lacking on adult return numbers and the genetic make-up of populations that return to tributaries of the Grande Ronde River basin. Attempts at maintaining weirs in streams to capture adult steelhead in the Grande Ronde River basin have met with limited success due to high spring flows. Adult summer steelhead return to Lookingglass Creek as evidenced by the weir counts at LH from 1997-2000. Data were also collected on summer steelhead adults returning to Lookingglass Creek during a study of spring Chinook salmon from 1964 to 1974 (Burck 1964-1974). We believe Lookingglass Creek data are important because they describe a population that may not have been affected by summer steelhead hatchery programs in the Grande Ronde River basin.

Data are also lacking on juvenile *O. mykiss* migration characteristics and the proportions of resident and anadromous forms found in tributaries. We have captured juvenile *O. mykiss* in our screw trap since 1992. At present we are unable to differentiate between the resident and anadromous forms of juvenile *O. mykiss* found in tributaries. The use of PIT tags may help in determining which of the juveniles captured at the screw trap result from the anadromous form. Since the spring of 1999 we began PIT-tagging juvenile *O. mykiss* captured in our screw trap to investigate their arrival timing and survival to Snake and Columbia River dams.

Methods

Adult Summer Steelhead Returns Trapped in Lookingglass Creek

Adult summer steelhead returning to Lookingglass Creek that were captured in the hatchery trap were enumerated by CTUIR in 2001. The trap at LH is usually installed to capture adult spring Chinook salmon. In 2001 the trap and weir were installed earlier than normal in an attempt to sample and enumerate adult summer steelhead passing the weir site. Returning fish were diverted by a picket weir into the upper trap near the hatchery intake (Figure 3).

In 2001 all adult summer steelhead captured were checked for fin clips, measured and opercle punched for identification. The fish were then placed immediately above the weir.

Genetic Monitoring

Adult Summer Steelhead

We used a paper hole punch to remove a small amount of tissue from the operculum of adult summer steelhead passing the Lookingglass Creek weir site. This tissue will be used for population genetics analysis. Individual tissue samples were immediately placed in vials and fixed with 70% ethanol. These tissue samples are being retained at our research office in La Grande, Oregon until funding can be acquired to analyze the samples.

Juvenile Oncorhynchus mykiss

Foreseeing the need for genetics data to manage the ESA listing of the summer steelhead, co-managers decided to collect tissue samples from Grande Ronde and Imnaha River basin juvenile *O. mykiss* populations each year beginning in 1999 and ending in 2002. These two basins were divided into 17 different units with one major tributary in each unit selected for sample collection (Figures 10 and 11). The NPT collected all of the samples from the Imnaha River basin. ODFW and CTUIR cooperatively sampled the Grande Ronde River basin. Up to 100 samples were collected from each tributary during mid-July. We directed our sampling towards smaller fish, < 100 mm (age 0+), to ensure that most of the juveniles were progeny of adult *O. mykiss* spawning the previous spring. To collect these juvenile fish, we used a Smith-Root electro-fisher (smooth or continuous DC, 400-600 volts). Fish were anaesthetized with 40-60 mg/l dose of MS-222 (tricaine methanesulfonate). A 1-2 mm diameter piece of caudal or anal fin was removed using scissors and immediately placed in a vial of ethanol for storage. The fish was then measured (FL) and placed in fresh water until it was fully recovered, then released near the area of capture. We attempted to sample a large portion of the rearing habitat available to the juvenile *O. mykiss* within each tributary. Some areas could not be sampled because some tributaries were dewatered, were located on private land, or were in deep canyons without easy access. Our criteria for the selection of sampling areas were to use areas of the stream that were currently easily accessible and would remain accessible in the future (e.g. road crossings on federal land). Depending on the length of the stream that was accessible, we also tried to distribute the sample sites evenly along the stream (every 1.0 or 0.5 miles).

Juvenile Migrant Trapping Using a Rotary Screw Trap

We have operated a screw trap in Lookingglass Creek since November 1993 to evaluate the spring Chinook salmon reintroduction program. During this time we have also captured juvenile *O. mykiss*. Trap operating procedures are reported in McLean and Lofy (1998). In 2001, all juvenile *O. mykiss* were removed from the trap, counted, and measured. Juvenile *O. mykiss* captured in our rotary screw trap were measured (fork length, mm), weighed (g) and enumerated (McLean and Lofy 1998). Trap efficiency tests were also conducted using PIT tagged fish using methods described for juvenile spring Chinook salmon in McLean and Lofy 1998. To graphically illustrate the distribution of sizes of fish captured at the screw trap over time, we divided fish into fork length intervals: small fish: <30-49, 50-69, 70-89, and 90-109 mm; medium fish: 110-129, 130-149, 150-169, and 170-189 mm; large fish: 190-209, 210-229, 230-249, and >249 mm.

PIT-tagging of Juvenile *O. mykiss* at the Rotary Screw Trap

We PIT-tagged all juvenile *O. mykiss* captured (>50 mm fork length) at our rotary screw trap to determine arrival timing at Lower Granite Dam. We also used these PIT-tagged fish to determine if there was a relationship between detection rate and timing and size of the fish at arrival at our screw trap. We will report the results of this tagging when detection data is complete in 2003.

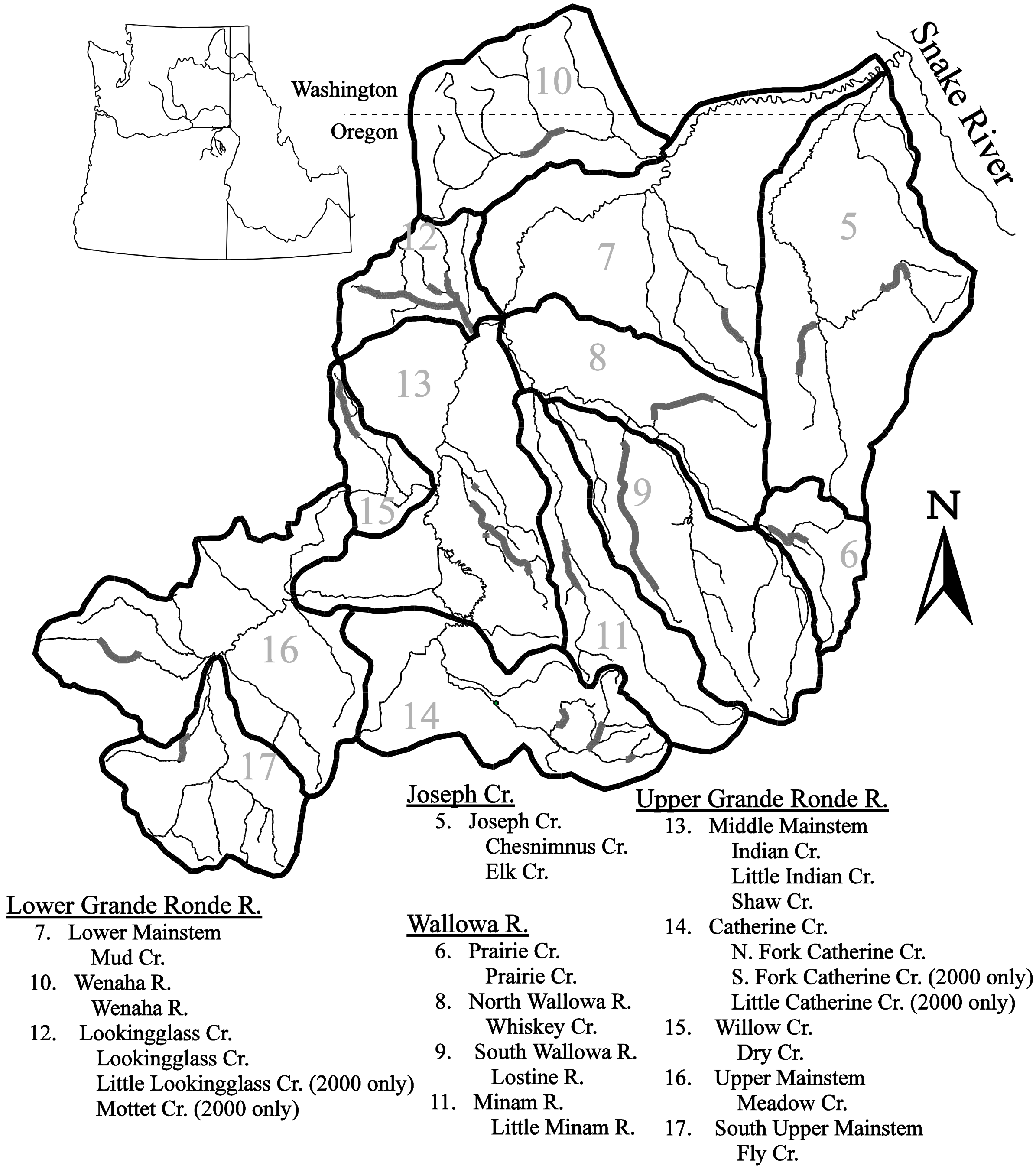

Figure 10. Map of the Grande Ronde River basin showing the 13 management units. Shaded areas on tributaries within each management unit indicate the juvenile *O. mykiss* sample area range.

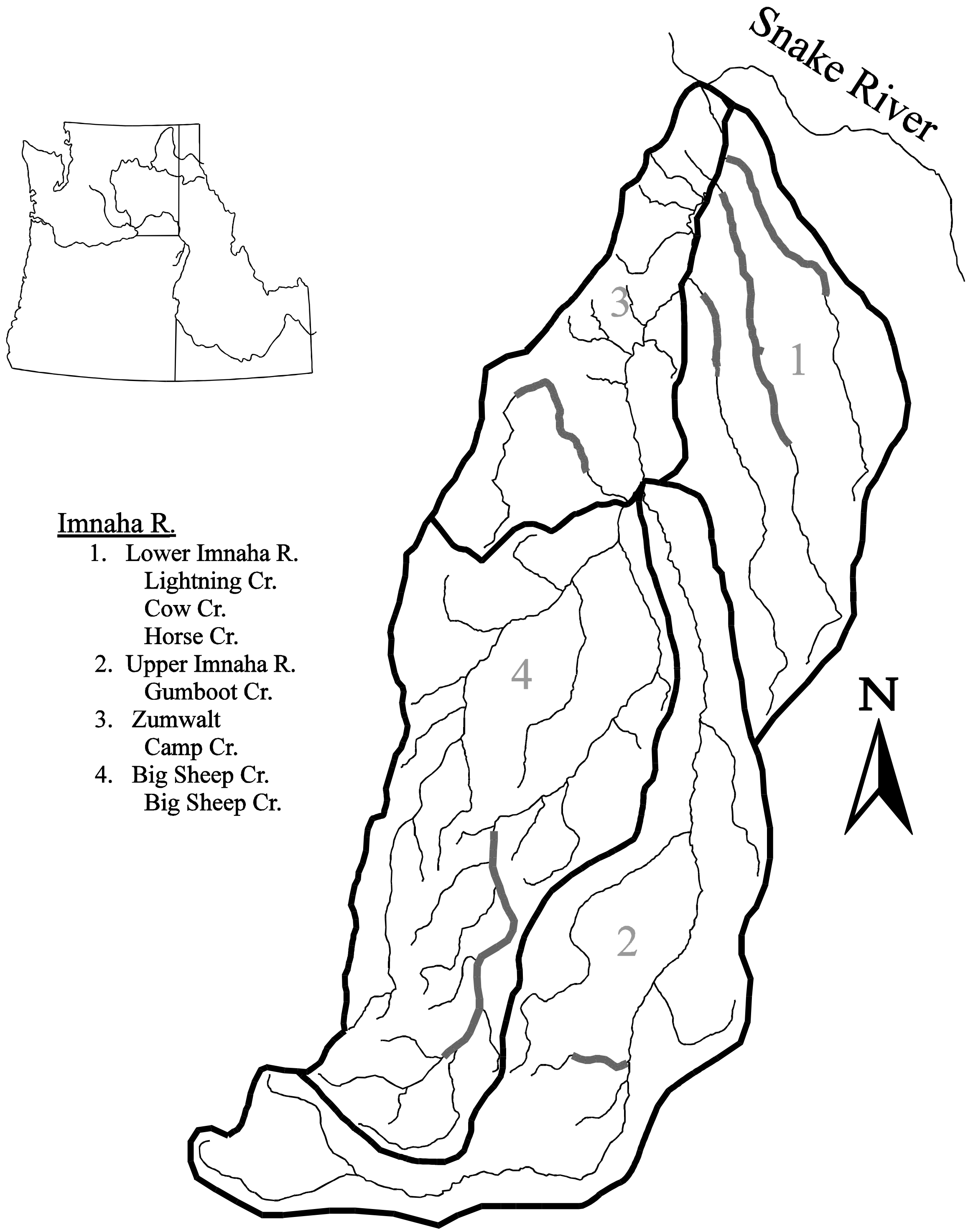

Figure 11. Map of the Imnaha River basin showing the 4 management units. Shaded areas on tributaries within each management unit indicate the juvenile *O. mykiss* sample area range.

Results/Discussion

Adult Summer Steelhead Returns Trapped in Lookingglass Creek

In 2001, the weir and trap were installed on 6 April and the first adult summer steelhead captured at the Lookingglass Creek trap was 9 April (Figure 12). We captured a total of 114 adult summer steelhead in 2001 and none of the fish were fin-clipped.

Genetic Monitoring

Adult Summer Steelhead

In 2001, we collected tissue samples from 114 unmarked adult summer steelhead trapped at the upper hatchery weir on Lookingglass Creek. After the tissue samples were collected, they were immediately placed in vials and fixed with ethanol. The tissue is being retained at our research office in La Grande, Oregon, until funding can be acquired to analyze the samples.

Juvenile Oncorhynchus mykiss

In 2001, co-managers sampled 55-100 juvenile *O. mykiss* from the sample stream in each unit of the Grande Ronde and Imnaha River basins used to index the genetic makeup of *O. mykiss* within each unit (Table 6, Figures 10 and 11). Samples were collected from 31 July-24 October 2001 with most collected the first 2 weeks of August. Size range of the fish collected was 19-87 mm fork length with the median length ranging from 33.5-65.0 mm.

Juvenile Migrant Trapping Using a Rotary Screw Trap

In 2001 we trapped a total of 2,509 *O. mykiss* (Table 7). Our trap efficiency estimates expanded that number to 39,052. The main peaks in *O. mykiss* movement past the trap in 2001 generally occur in the spring (March to June) and in the fall (September to October) (Figure 13). The small, medium, and large (FL) groups had similar peaks in April and October, with the small group having a second peak 2 months later in the spring. In 2001 the percentage of fish moving past the trap from the large (FL) group was 7.2% in comparison to the medium (FL) and small (FL) groups at 58.4 and 34.4% respectively.

PIT-tagging of Juvenile *O. mykiss* at the Rotary Screw Trap

In 2001 we PIT-tagged 2,200 juvenile *O. mykiss* at the rotary screw trap ranging in size from 48-326 mm.

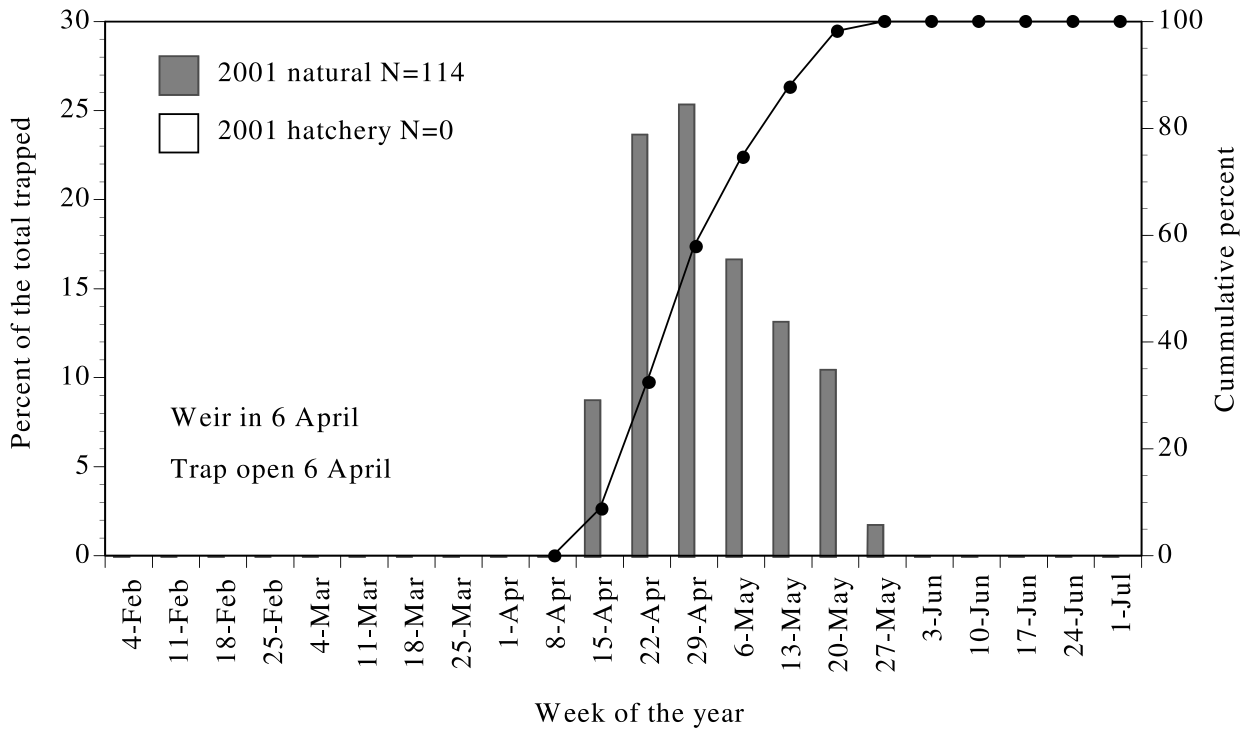

Figure 12. Arrival timing of adult summer steelhead at a trap on Lookingglass Falls in 2001.

Table 6. Juvenile *O. mykiss* sample locations and dates, number collected, and fork length range and median in 2001.

Basin	Mngmt. unit[a]	Sample location	N[b]	Fork length (mm) range	Fork length (mm) median	Dates collected
Grande Ronde R.						
	5	Chesnimnus Cr.[c]	100	36 - 63	49.0	21-Aug
	5	Elk Cr.[c]	82	36 - 87	57.0	21-Aug
	6	Prairie Cr.	75	37 - 84	53.0	2-Aug
	7	Mud Cr.	66	37 - 60	50.0	1-Aug
	8	Whiskey Cr.	100	38 - 79	56.0	31-Jul
	9	Lostine R.	74	23 - 62	38.0	14-Aug
	10	Wenaha R.	100	28 - 52	38.0	6-Aug
	11	Little Minam R.	70	27 - 47	33.5	9-Aug
	12	Lookingglass Cr.	85	21 - 66	39.0	15,17-Aug
	13	Indian Cr.	69	20 - 72	40.0	3-Aug
	14	Catherine Cr.	79	19 - 64	45.0	22-Aug
	15	Dry Cr.	55	29 - 54	40.0	31-Jul
	16	Meadow Cr.	51	38 - 75	56.0	2,29-Aug
	17	Fly Cr.	79	39 - 79	57.0	16-Aug
Imnaha R.						
	1	Lightning Cr.[c]	81	28 - 57	40.0	31-Jul
	1	Horse Cr.[c]	70	34 - 69	53.0	24-Oct
	1	Cow Cr.[c]	93	34 - 75	58.0	30-Jul, 8-Oct
	2	Gumboot Cr.[c]	90	31 - 72	39.0	27-Jul
	3	Camp Cr.[c]	77	44 - 78	65.0	3-Oct
	4	Big Sheep Cr.[c]	74	33 - 75	50.0	24-Jul, 4-Oct

[a] *The map units can be found in Figures 14 and 15. The NPT also sampled Elk Creek from map unit 5 in the Grande Ronde Basin and Horse and Cow Creeks from map unit 1 in the Imnaha Basin.*

[b] *The N shown is the total number collected from the stream.*

[c] *Taken from Miller et al. 2002.*

Table 7. Juvenile *O. mykiss* that were captured in a rotary screw trap, releases and recaptures from trap efficiency tests, and the estimated number of migrants from Lookingglass Creek during 2001.

Month	Total trapped	Trap efficiency release	Trap efficiency recapture	% Trap efficiency[a]	Population Estimate
Jan	11	11	0	14.35	77
Feb	3	3	0	14.35	21
Mar	212	202	31	14.35	1,477
Apr	858	707	64	9.05	9,478
May	141	140	7	5.00	2,820
Jun	225	225	6	2.67	8,438
Jul	49	48	3	6.25	784
Aug	106	106	2	1.89	5,618
Sep	100	78	4	5.13	1,950
Oct	631	513	47	9.16	6,887
Nov	156	148	18	11.52	1,355
Dec	17	17	1	11.52	148
Totals	2,509	2,198	183		39,052

[a] *Because the trap efficiency release was less than 25 fish for the months of January, February, and December the releases were combined with March(January-March) and November(November-December) to make one trap efficiency estimate that was used for each individual month.*

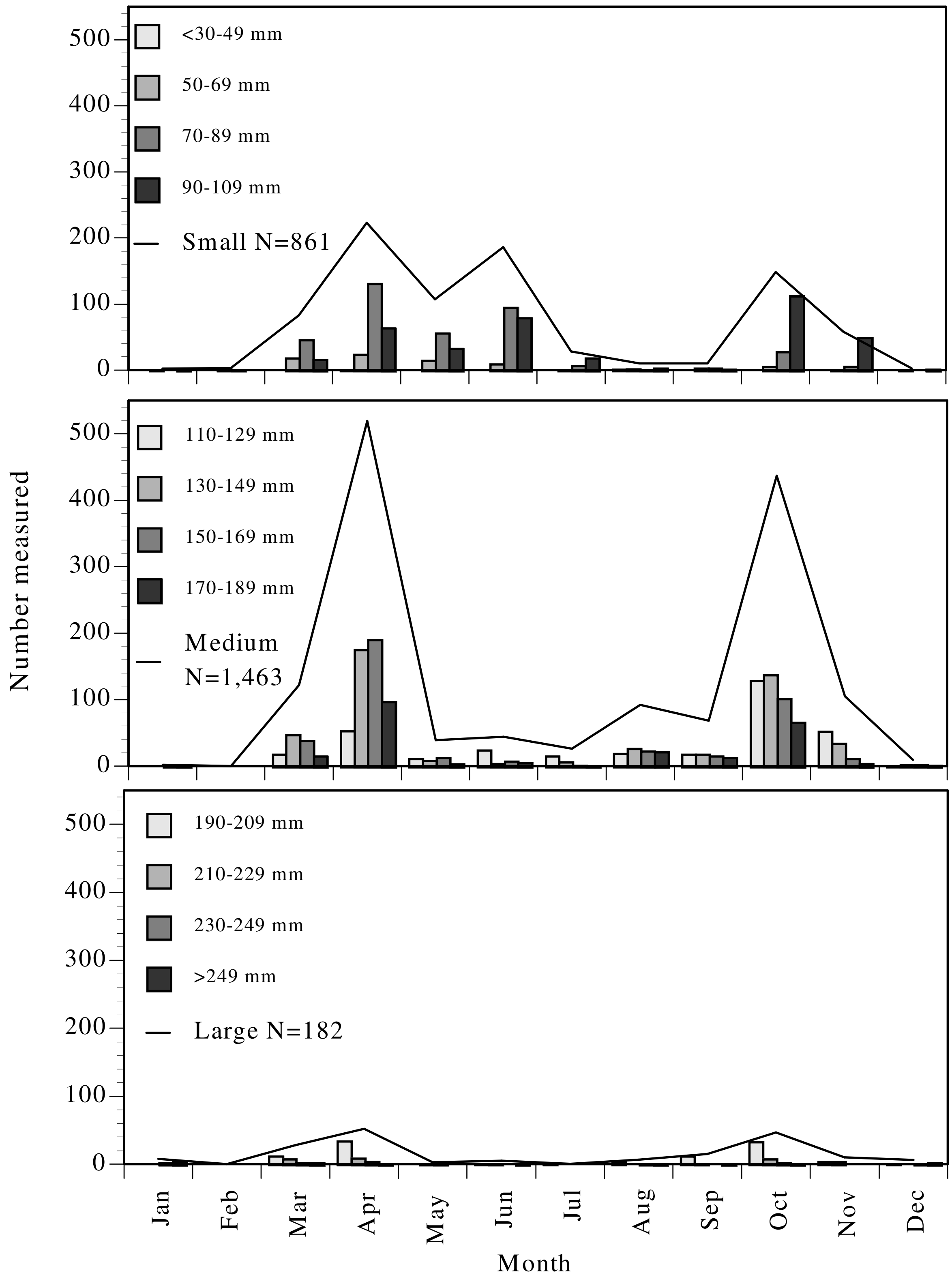

Figure 13. Monthly *O. mykiss* arrival timing by fork length group at the screw trap on Lookingglass Creek in 2001.

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SECTION II

Assistance Provided to LSRCP Cooperators and Other Projects

We provided assistance to LSRCP cooperator ODFW in 2001 for ongoing hatchery evaluation research. Project personnel completed extensive spawning ground surveys for spring Chinook salmon in the Grande Ronde and Imnaha river basins. We provided assistance in pre-release sampling of spring Chinook salmon at LH. In addition, project personnel provided assistance in sampling adult spring Chinook salmon at Oregon LSRCP facilities and helped with the release of juvenile spring Chinook salmon parr into Lookingglass Creek. Assistance was provided in data summarization and analysis for ODFW monthly and annual progress reports.

We assisted other Bonneville Power Administration (BPA) projects with data collection in 2001. We assisted ODFW personnel who have been collecting data on bull trout (*Salvelinus confluentus*) in the Grande Ronde River basin. We have collected fork length and weight data from bull trout we have captured in Lookingglass Creek in our screw trap and those captured in the LH adult bypass. In addition, we have implanted PIT tags in bull trout we have captured in our rotary screw trap. We assisted the conventional adult spring Chinook salmon broodstock collection project in the Grande Ronde River and Catherine Creek in 2001 with weir building and trap checking. This is a BPA project in which CTUIR has the lead in these tributaries.

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A special thanks to ODFW for the use of their PIT-tagging data from tributaries of the Grande Ronde River basin.

Appendix Tables

Appendix Table A-1. Redd count and redd expansion data for the Grande Ronde River in 2001. Source: ODFW Research, La Grande, unpublished data[a].

Survey			Unit number									Redds		Est.
Year	Date	type	1	2	3	4	5	6	7	8	9	Total	Exp.	Pop.[b]
Index redds 1986-1994			290	166	64									
Unit proportions			0.57	0.32	0.12									
2001	27-Aug	Index	2		0									
	4-Sep	Supp.	4	0	2									
	10-Sep	Supp.	1		6							**15**		
	Expansion		**7**	**0**	**8**								**15**	
	Redress		7	0	8								**15**	49

[a] *Expansion is based on unit proportions. Only index surveys for years when all sections were surveyed were used to calculate the unit proportions (McLean and Lofy 2001). Unit proportions are the total number of redds counted in each unit during the index survey and any surveys prior to the index survey divided by the total redds for all sections. These proportions were used to estimate the total number of redds for sections when a survey was not done. Redress is used to update the unit expansions when the expanded number of redds is less than the actual number of redds counted.*

[b] *The estimated population is calculated by multiplying the total expanded redress redds by 3.26 fish-per-redd. The average 3.26 fish-per-redd was calculated from fish-per-redd estimates in Lookingglass Creek from 1992-1994 (Lofy and M^{c}Lean 1995a; Lofy and M^{c}Lean 1995b; M^{c}Lean and Lofy 1995)*

Appendix Table A-2. Redd count and redd expansion data for Catherine Creek in 2001. Source: ODFW Research, La Grande, unpublished data[a].

Survey			Unit number									Redds		Est.
Year	Date	type	1	2	3	4	5	6	7	8	9	Total	Exp.	Pop.[b]
Index redds 1986-2000			92	11	87	148	166	96	111					
Unit proportions			0.13	0.02	0.12	0.21	0.23	0.14	0.16					
2001	28-Aug	Index	10	0	1	12	9	1	1					
	5-Sep	Supp.	7	0	0	5	29	3	18					
	11-Sep	Supp.	0	0	0	3	6	8	20			**133**		
	Expansion		**17**	**0**	**1**	**20**	**44**	**12**	**39**				**133**	
	Redress		17	0	1	20	44	12	39				**133**	434

[a] *Expansion is based on unit proportions. Only index surveys for years when all sections were surveyed were used to calculate the unit proportions (McLean and Lofy 2001). Unit proportions are the total number of redds counted in each unit during the index survey and any surveys prior to the index survey divided by the total redds for all sections. These proportions were used to estimate the total number of redds for sections when a survey was not done. Redress is used to update the unit expansions when the expanded number of redds is less than the actual number of redds counted.*

[b] *The estimated population is calculated by multiplying the total expanded redress redds by 3.26 fish-per-redd. The average 3.26 fish-per-redd was calculated from fish-per-redd estimates in Lookingglass Creek from 1992-1994 (Lofy and McLean 1995a; Lofy and McLean 1995b; McLean and Lofy 1995)*

Appendix Table A-3. Redd count and redd expansion data for the Lostine River in 2001. Source: ODFW Research, La Grande, unpublished data[a].

Survey			Unit number									Redds		Est.
Year	Date	type	1	2	3	4	5	6	7	8	9	Total	Exp.	Pop.[b]
Index redds 1986-2000				27	2	222	18	8	1	3				
Unit proportions				0.10	0.01	0.79	0.06	0.03	0.00	0.01				
2001	24-Aug	Index	0	11	2	41	1	0	0	1				
	31-Aug	Supp.	0	5	0	11	2	0	0	14				
	7-Sep	Supp.	0	5	0	18	0	0	1	6				
	14-Sep	Supp.								12				
	21-Sep	Supp.								0				
	28-Sep	Supp.			1					0		**131**		
	Expansion			**21**	**3**	**70**	**3**	**0**	**1**	**33**			**131**	
	Redress			21	3	70	3	0	1	33			**131**	427

a *Expansion is based on unit proportions. Only index surveys for years when all sections were surveyed were used to calculate the unit proportions (McLean and Lofy 2001). Unit proportions are the total number of redds counted in each unit during the index survey and any surveys prior to the index survey divided by the total redds for all sections. These proportions were used to estimate the total number of redds for sections when a survey was not done. Redress is used to update the unit expansions when the expanded number of redds is less than the actual number of redds counted.*

b *The estimated population is calculated by multiplying the total expanded redress redds by 3.26 fish-per-redd. The average 3.26 fish-per-redd was calculated from fish-per-redd estimates in Lookingglass Creek from 1992-1994 (Lofy and McLean 1995a; Lofy and McLean 1995b; McLean and Lofy 1995)*

Appendix Table A-4. Redd count and redd expansion data for the Minam River in 2001. Source: ODFW Research, La Grande, unpublished data[a].

Survey			Unit number									Redds		Est.
Year	Date	type	1	2	3	4	5	6	7	8	9	Total	Exp.	Pop.[b]
Index redds 1986-2000			26	14	30	28	47	31	133	28	72			
Unit proportions			0.06	0.03	0.07	0.07	0.11	0.08	0.33	0.07	0.18			
2001	29-Aug	Index	4	11	8	14	17	18	32	21	3			
	5-Sep	Supp.				3	5	4	23					
	17-Sep	Supp.				0	1	3	12			179		
	Expansion		*14*	*8*	*17*	**17**	**23**	**25**	**67**	*15*	*40*		**226**	
	Redress		14	11	17	17	23	25	67	21	40		**235**	765

a *Expansion is based on unit proportions. Only index surveys for years when all sections were surveyed were used to calculate the unit proportions (McLean and Lofy 2001). Unit proportions are the total number of redds counted in each unit during the index survey and any surveys prior to the index survey divided by the total redds for all sections. These proportions were used to estimate the total number of redds for sections when a survey was not done. Redress is used to update the unit expansions when the expanded number of redds is less than the actual number of redds counted.*

b *The estimated population is calculated by multiplying the total expanded redress redds by 3.26 fish-per-redd. The average 3.26 fish-per-redd was calculated from fish-per-redd estimates in Lookingglass Creek from 1992-1994 (Lofy and McLean 1995a; Lofy and McLean 1995b; McLean and Lofy 1995)*

Appendix Table A-5. Redd count and redd expansion data for the Wenaha River in 2001. Source: ODFW Research, La Grande, unpublished data[a].

Survey			Unit number									Redds		Est.
Year	Date	type	1	2	3	4	5	6	7	8	9	Total	Exp.	Pop.[b]
Index redds 1986-2000			14	5	329	147	70	119	14					
Unit proportions			0.02	0.01	0.47	0.21	0.10	0.17	0.02					
2001	6-Sep	Index		3	88	64	17	41	11					
	13-Sep	Supp.		0	18	4	6	12				264		
	Expansion		**0**	**3**	**106**	**68**	**23**	**53**	**11**				**264**	
	Redress		0	3	106	68	23	53	11				**264**	861

[a] *Expansion is based on unit proportions. Only index surveys for years when all sections were surveyed were used to calculate the unit proportions (McLean and Lofy 2001). Unit proportions are the total number of redds counted in each unit during the index survey and any surveys prior to the index survey divided by the total redds for all sections. These proportions were used to estimate the total number of redds for sections when a survey was not done. Redress is used to update the unit expansions when the expanded number of redds is less than the actual number of redds counted.*

[b] *The estimated population is calculated by multiplying the total expanded redress redds by 3.26 fish-per-redd. The average 3.26 fish-per-redd was calculated from fish-per-redd estimates in Lookingglass Creek from 1992-1994 (Lofy and McLean 1995a; Lofy and McLean 1995b; McLean and Lofy 1995)*

Appendix Table A-6. Carcass recoveries and age structure for Grande Ronde River basin tributaries in 2001. Source: ODFW Research, La Grande, unpublished data.

Run		Scale age				Basin age structure		
Year	Tributary	3	4	5	Total	3	4	5
2001	Grande Ronde R.	0	6	0	6			
	Catherine Cr.	2	39	11	52			
	Lostine R.	2	39	25	66			
	Minam R.	2	30	13	45			
	Wenaha R.	3	45	23	71			
	Totals	**9**	**159**	**72**	**240**	**0.04**	**0.66**	**0.30**