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DETERMINING ADULT PACIFIC LAMPREY ABUNDANCE AND SPAWNING HABITAT IN THE LOWER DESCHUTES RIVER SUB-BASIN, OREGON

2008 Annual Report

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ABSTRACT

An adult Pacific lamprey (*Lampetra tridentata*) escapement estimate was generated in the lower Deschutes River during run year 2008. This included a mark-recapture study to determine adult abundance and a tribal subsistence creel. Fish measuring less than 10.5 cm received two marks for the mark-recapture estimate while those measuring greater than 10.5 cm were surgically implanted with radio transmitters to monitor migration upstream of Sherars Falls (rkm 70.4). Radio telemetry was used to determine habitat, focal spawning areas and spawn timing. All fish were collected at the Sherars Falls fish ladder from July – October 2008 using a long handled dip-net. Escapement was generated using a two event mark-recapture experiment. Adult lamprey populations were estimated at 3,471 (95% CI = 2,384-5,041; M = 101; C = 885 R = 25) using Chapman's modification of the Peterson estimate. The relative precision around the estimate was 31.42. Tribal harvest was approximately 806 adult lamprey (95% CI= +/- 74) with a total escapement of 2,669. Fourteen lamprey received radio tags and were released at Lower Blue Hole recreation site (rkm 77.3). Movement was recorded by mobile, fixed site and aerial telemetry methods. Upstream movements of lamprey were documented from July through December 2008 with most lamprey over-wintering in the mainstem Deschutes River.

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INTRODUCTION

Three species of lamprey are endemic to the Columbia River Basin (CRB). Pacific lamprey *Lampetra tridentata* and river lamprey *Lampetra ayresi* are anadromous (Beamish 1980), while the western brook lamprey *Lampetra richardsoni* completes it's lifecycle in freshwater (Beamish et al. 1982). Limited information on distribution and abundance is available for river lamprey and western brook lamprey within the CRB; however, studies in Canada have described biology of these two species (Beamish 1987; Beamish 1980; Beamish and Withler 1986; Beamish and Youson 1986; Richards et al. 1982; Vladykov and Follett 1965; and Vladykov and Follett 1958). While Pacific lamprey life history information is available, many critical uncertainties remain (Beamish 1980; Beamish and Levings 1991; Close 1995; Pletcher 1963; Scott and Crossman 1973; van de Wetering 1998). Multiple projects are underway in the CRB to address these uncertainties (Bayer et al. 2000; 2001; 2002; Close et al. 1995; Close 1998; 1999; 2000; 2001; Jackson 1996; 1997).

Pacific lamprey were once widely distributed throughout the CRB (Kan 1975; Wydoski and Whitney 1979), but have dramatically declined since the 1940's (Close et al. 1995). Historic information on Pacific lamprey distribution and abundance is limited. Upstream migrant counts at Columbia River dams are used to assess declining trends in Pacific lamprey abundance (Kostow 2002). In 1993, the state of Oregon listed Pacific lamprey as a sensitive species and increased their protection status in 1997 (OAR 635-044-0130) (Kostow 2002). During 2003, in response to range-wide declines in lamprey populations, special interest groups throughout Oregon, Washington, and California petitioned United States Fish and Wildlife Service (USFWS), for Pacific lamprey (as well as river lamprey, western brook lamprey, and Kern brook lamprey) to be listed as a threatened or endangered species throughout their range from Mexico to Canada. While USFWS acknowledged declines in Pacific lamprey, it was determined they were not suitable for listing due to their extensive geographic range (50 CFR-17, 77158, December 27, 2004).

Numerous factors may be leading to declines of Pacific lamprey abundance. Poor mainstem passage is cited as a major reason for decline (CBPLTWG 1999; Kostow 2002; Long 1968; Vella et al. 1999a; Vella et al. 1999b). Poor passage efficiencies attribute to apparent decreases in upstream migration (Moser et al. 2002a). Lack of "lamprey friendly" screening at hydroelectric facilities may have sizeable impacts on outmigrating Pacific lamprey (Kostow 2002). Degraded tributary habitat throughout their range including, but not limited to, decreased flows, increased water temperatures, and poor riparian habitat may also explain apparent declines (CBPLTWG 1999; Close et al. 1995).

The ecological, economic, and cultural significance of Pacific lamprey has been underestimated by many (Close et al. 1995; CRITFC 1995; Kan 1975; NPPC 1995). For Native American tribes of the Pacific Coast, Pacific lamprey are an important subsistence, ceremonial, and medicinal resource (Close et al. 1995; CRITFC 1995; Hunn and Selam 1991; Pletcher 1963). Confederated Tribes of Warm Springs Reservation, Oregon (CTWSRO) tribal fishers harvest Pacific lamprey at Sherars Falls in the lower Deschutes River. Insufficient numbers of Pacific lamprey for cultural requirements force tribal harvesters to collect lamprey at alternate locations including Willamette Falls, on the Willamette River, located in Oregon City, Oregon.

Information concerning lamprey habitat requirements and exploitation in the lower Deschutes River Sub-basin is limited (Kan 1975; Hammonds 1979; Beamish 1980). Baseline information must be collected and analyzed in order to formulate an effective recovery plan for Deschutes River lampreys. Project objectives are to: (1) Continue a mark-recapture study to estimate adult Pacific lamprey escapement over Sherars Falls and monitor tribal harvest at Sherars Falls; and (2) Determine Pacific lamprey spawning habitat in the lower Deschutes River.

STUDY AREA

The lower Deschutes River Sub-basin is located in central Oregon, draining the east slope of the Cascade mountain range (approximately 6,993 km^2) with 1,223 km of perennial streams and 2,317 km of intermittent streams. A series of hydroelectric dams begin at Rkm 161. Currently, lamprey passage does not exist at these facilities. Major tributaries of the lower Deschutes River are White River, Warm Springs River and Shitike Creek to the west and to the east Buck Hollow, Bakeoven, and Trout creeks.

Majority of perennial tributaries within the lower Deschutes River Sub-basin originate within the boundaries of the Confederated Tribes of Warm Springs Reservation. The Reservation covers 240,000 ha on the eastern slopes of the Cascade Mountains. The Reservation boundaries are the crest of the Cascades to the north and west, Deschutes River to the east and Metolius River to the south. The Warm Springs River is the largest watershed within the Reservation, flowing 85 kilometers and draining 54,394 ha. and is the largest tributary to the lower Deschutes River. Major tributaries to the Warm Springs River are Beaver and Mill creeks. Shitike Creek is the third largest tributary to the lower Deschutes River flowing for 48 Rkm and draining 36,000 ha.

The project is implemented in the mainstem Deschutes River from its confluence of the Columbia River to rkm160 and includes westside tributaries entering this reach. Sherars Falls is located at rkm 70.4 and is the primary harvest location for CTWSRO tribal members. A fish ladder around Sherars Falls provides a convenient site for collecting and marking lamprey in addition to monitoring tribal harvest. Fixed Sites were located in the mainstem Deschutes River, Warm Springs River drainage, and Shitike Creek. We anticipate tracking lamprey to their final spawning locations in Warm Springs River drainage and Shitike Creek.

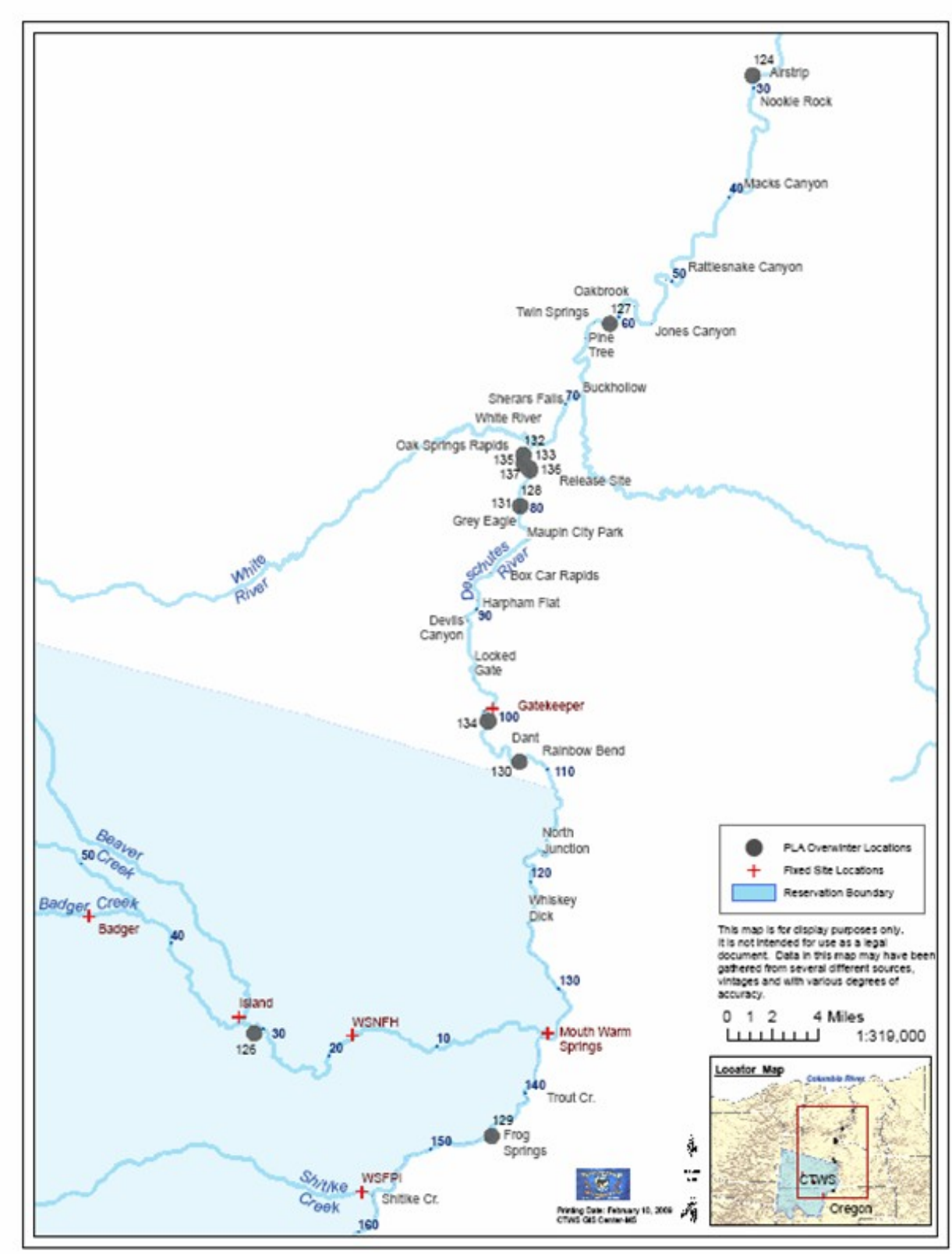

Figure 1. Map of Deschutes River Sub-basin and adult Pacific lamprey study locations, 2008 – 2009.

SECTION I: ADULT PACIFIC LAMPREY ESCAPEMENT ESTIMATE IN THE LOWER DESCHUTES RIVER

METHODS

Abundance Estimate

A systematic approach was developed to collect adult Pacific lamprey using a long-handled dip net at Sherars Falls fish ladder, located at rkm 70.4 in the lower Deschutes River (Figure 1). Sampling occurred seven nights per week from mid July – late September and five randomly selected nights per week for the duration of the project. The fish ladder contains 10 pools, each of which were dipped twice per hour, for 4 – 6 hours per night. Dipping occurred in the same location during each sampling event. Captured adult Pacific lamprey were fitted with a floy tag, fin clipped, weighed, and measured**.** Sequentially numbered floy tags were anchored approximately 0.5 cm inferior to the posterior of the dorsal fin. Each lamprey received a secondary mark which consisted of a fin clip at the posterior end of the dorsal fin. Once marked, lamprey were transported approximately 2 rkm downstream to Buckhollow Landing and released. Subsequently captured lamprey were inspected for tag presence and a fin clip. Recaptures were recorded and released upstream of the fish ladder. A primary tag retention rate was calculated based on tag presence or tag wound and fin clip. Adult Pacific lamprey abundance was estimated using Chapman's modification of the Petersen estimate (Seber 1982). Estimated abundance (N*) was derived from:

$$N^* = \frac{(M+1)(C+1)}{(R+1)} - 1$$

where *M* is number of fish marked in first event sampling, *C* is total fish inspected for marks, and *R* is the number of fish inspected for marks in second event sampling possessing marks.

Chapman's modified estimate uses a Poisson approximation to the hypergeometric distribution and approaches a minimum variance unbiased estimator of population size with variance approximated by:

$$V(N^*) = N^2\left(\mu^{-1} + 2\mu^{-2} + 6\mu^{-3}\right)$$

where $\mu = MC/N$

For *N** to be a suitable estimate the following assumptions must be met:

1. *All Pacific lamprey have an equal probability of being marked at Sherars Falls fish ladder;* ***or***
2. *All fish have an equal probability of being inspected for marks;* ***or***
3. *Marked fish mix completely with unmarked fish between sampling events;* ***and***

4. No recruitment into the population between sampling events; ***and***

5. No sampling-induced behavior or mortality; ***and***

6. Fish do not lose their marks and marks are recognizable.

To determine if assumptions 1 and 2 were violated, a chi-squared analysis was performed comparing length distributions between dipnetting and tribal harvest. To ensure mixing, all marked Pacific lamprey were transported and released approximately 2 rkm downstream of the initial capture site (assumption 3). To minimize potential for fish to be introduced into the experimental population, tagging was conducted throughout the majority of the run; therefore assumption 4 was not violated. It is possible for lampreys to enter the experimental population after first event sampling is completed. However, first event sampling was suspended when lampreys were no longer present in the fish ladder after three successive dipping procedures. There is no direct mortality associated with dipnetting and indirect mortality cannot be evaluated but is assumed negligible (assumption 5). Only fish in good condition were marked and released. No deceased, marked lampreys were reported downstream of the first event sampling site during the marking phase of the experiment. To reduce the potential for tag loss, secondary marks were applied (assumption 6). Tag loss was determined by presence of a tag wound and fin clip.

Tribal Harvest Monitoring

In conjunction with marking and recapturing adult lamprey, a single access site creel survey was conducted to estimate tribal harvest of adult Pacific lamprey. Interviews were conducted throughout the sampling period July – September 2008. Creel surveys occurred from 9 pm until tribal fisherman completed collection or 3 am, whichever occurred first. Creelers examined all harvested lamprey for marks and recorded total lengths. Numbers of marked (non-expanded numbers) and unmarked lampreys were recorded on datasheets. Creel numbers were expanded to estimate total harvest and 95% confidence intervals generated.

Total effort and harvest was expanded from each sampling day by:

Total Effort: $$\hat{\mathrm{E}} = \sum_{i=1}^{n} (e_i / \pi_i)$$

Total Catch: $$\hat{C} = \sum_{i=1}^{n} (c_i / \pi_i)$$

Variance was approximated each sampling week by:

$$Var(\hat{E}_1) \approx N_1^2 Var(\bar{e}_1)$$

Weekly variances were summed to estimate total variance of the harvest estimate.

RESULTS AND DISCUSSION

Abundance Estimate

Between 16 July and 6 October 2008, 101 adult Pacific lampreys were tagged at Sherars Falls and 885 inspected for marks (Table 1). Our preliminary population estimate for adult Pacific lamprey in the Deschutes River during 2008 was 3,475 (2,384 – 5,041). The escapement over Sherars Falls was 2,669.

All adult Pacific lampreys collected during first event sampling received numbered Floy tags and fin clips. Twenty-five (24.8%) lampreys were recaptured. Of those, seven (28.0%), 15 (60.0%), and three (12.0%) were recaptured through long handled dipnetting, tribal creel, and tribal member tag returns, respectively. No significant difference was found between marked and inspected adult Pacific lamprey lengths ($X^2 = 9.78$; df = 6; P = 0.134; Figure 2).

Tag retention rates were calculated based on presence of a fin clip and tag wound. Eighteen of 25 recaptured lampreys retained their tags (72.0%)(Table 2). Mean movement rate from Buckhollow Landing to Sherars Falls was estimated to be 3.03 days based on 15 recaptured fish with numbered tags.

Tribal Harvest Monitoring

Twenty-three creel interviews were conducted from 16 July – 19 September 2008. A total of 485 Pacific lamprey were measured and inspected. A preliminary estimate of tribal harvest was 806 (+/- 74) (Table 3). Based on preliminary population estimates and tribal harvest we estimated an exploitation rate of 23.2%. Descriptive statistics and length frequency histograms for both marked and creeled lamprey can be found in Appendix B.

Table 1. Adult Pacific lamprey population estimates in the lower Deschutes River, 2008.

Year	No. Tagged	No. Inspected	No Recoveries	Population Size	Variance	Standard Error	Relative Precision
2008	101	885	25	3,475	323,620	569	32.1%

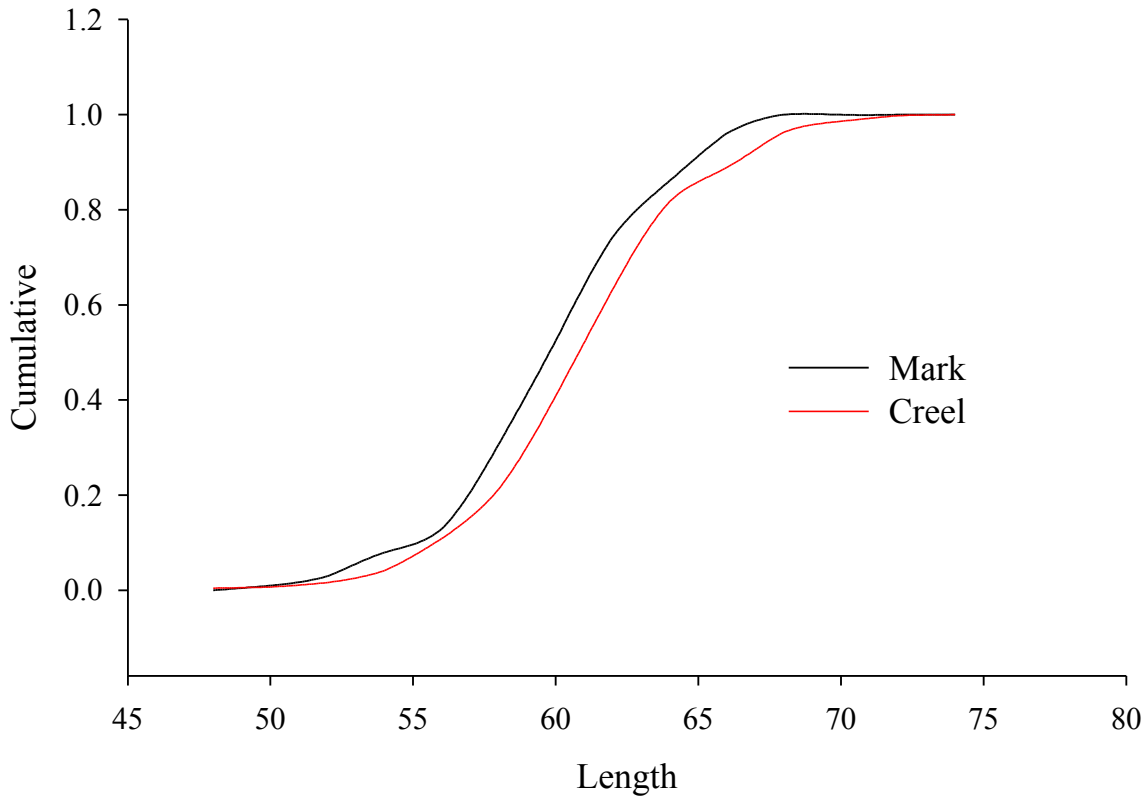

Figure 2. Cumulative length frequencies of adult Pacific lamprey collected through dipnetting versus tribal harvest at Sherars Falls, lower Deschutes River, 2008.

Table 2. Adult Pacific lamprey with Floy tag at Sherars Falls, lower Deschutes River, 2008.

Tag Type	Pacific Lamprey	Retention
Numbered Floy Tag		72%

Table 3. Summary of adult Pacific lamprey tribal harvest creel at Sherars Falls, lower Deschutes River, 2008.

Year	Dates	Interviews Conducted	Lamprey Creeled	Estimated Harvest
2008	7/16 - 9/19	23	458	791

SECTION II: DETERMINE PACIFIC LAMPREY SPAWNING HABITAT IN THE LOWER DESCHUTES RIVER SUB-BASIN

METHODS

Radio Tagging

From 21 July to 18 September 2008 adult Pacific lamprey were fitted with radio tags. Experimental lamprey with a girth measurement of 10.5 cm or greater were collected at Sherars Falls fish ladder and transported upstream for holding and transmitter implantation. Individuals were held up to 48 hours prior to surgery. Unique frequency transmitters (Lotek Engineering, Inc., Ontario, Canada; model NTC-6-2) were surgically implanted into adult lamprey. All were released at Lower Blue Hole Recreation Site (LBH) located at Rkm 77.3. This site was selected to minimize the potential for radio tagged lamprey to move below Sherars Falls or be captured by Tribal fishers. Sex, total length (cm), weight (g) and mid-girth (cm) measurements were recorded prior to surgery.

Radio transmitters were surgically implanted using methods developed by National Oceanic and Atmospheric Administration Fisheries (Bayer et al. 2000). A buffered solution of eugenol (5 mL: 50 L water) was used to anesthetize lamprey prior to the implantation procedure. After anesthetized, lamprey were placed into a large cooler with a cylindrical tube to hold individuals during surgical procedures. Lamprey were placed posterior side up in the trough and bathed in a solution of buffered eugenol (1 mL:16 L water). An incision approximately 2 cm in length was made longitudinally, just off the mid-line. A sheathed catheter was inserted into the incision and pierced through the musculature, approximately 1 - 3 cm posterior of the incision. The catheter was removed, leaving the sheath. Antenna first, transmitters, were inserted through the sheath, into the body cavity and the sheath removed. Three evenly spaced sutures using 4/0 absorbent suture material closed the incision. Once suturing was completed, oxytetracycline (100 mg/ml) was injected under the sutures. Antibacterial ointment was placed along the incision. After surgery lamprey were moved into a covered, aerated holding box to recover. All lamprey were released during or post sunset.

Fixed Sites

Fixed-site telemetry receiving stations were used to monitor movement of radio tagged lamprey in the lower Deschutes River Sub-basin (Table 4; Figure 1). Six fixed sites captured transmitter signals from passing lamprey along the lower Deschutes River, Warm Springs River, Badger, Shitike and Beaver creeks. Data collected included tag code, date, time, and signal strength. Data was downloaded from receivers as needed (i.e., weekly during movement periods, monthly during holding periods). Fixed site receivers recorded data continuously throughout the year. Water temperature data loggers (Hobo Water TempPro™, Onset Computer Corporation, Pocassett, MA) were located adjacent to fixed sites. Data was logged continuously through the completion of spawning to record seasonal variations in water temperature.

Mobile Tracking

Ground surveys consisted of a mobile tracking receiver and hand-held antenna. After the first release of radio tagged lamprey, ground surveys were conducted 2 - 4 times a week while fish

Table 4. Adult lamprey capture, release sites and fixed-site telemetry receiver locations in the lower Deschutes River Sub-basin, 2008 - 2009.

Site Name	Stream	Rkm	Status
Sherars Falls (Capture Location)	Deschutes	70.4	Capture Location
Lower Blue Hole Rec. Site	Deschutes	77.3	Release Site
Dant	Deschutes	99.8	Fixed Site
PRB Reregulation Dam	Deschutes	160	Passage Barrier
Mouth of Warm Springs	Warm Springs River	0.1	Fixed Site
Warm Springs Fish Hatchery	Warm Springs River	10.7	Temp Fixed Site
Island	Warm Springs River Beaver Creek	19.3 0.3	Fixed Site
B-100	Badger Creek	3.0	Fixed Site
Warm Springs Forest Products	Shitike Creek	1.7	Fixed Site

were moving. Once holding was established, surveys were conducted weekly or biweekly. Tracking was accomplished by vehicle, foot and kayak to pinpoint lamprey locations. Global Positioning System (GPS) coordinates were logged at the location of highest signal strength. Additional data collected included: time, date, location (rkm, to the nearest tenth), general river channel description, weather, and digital photograph.

Aerial Surveys

Aerial surveys were conducted from a chartered fixed-wing aircraft equipped with aerial telemetry antennae. The most recent survey of the Deschutes River, Warm Springs River, Beaver and Shitike creeks was completed 3 December 2008. We plan to conduct reconnaissance flights monthly from April – July 2009; however, the actual frequency of aerial surveys will be determined by rate of migration.

Spawning Habitat
When redd building or courting behavior was observed, locations were recorded for further observation. Multiple passes of the area were conducted to determine if spawning occurred. If a lamprey was radio tagged, radio transmitters were retrieved when possible. Thermograph data was retrieved after the spawning season was completed. Data was summarized using Eel River Water Temperature Analysis Program V.97.8^{C}. Redd and spawning habitat characteristics were recorded (Table 5).

PRELIMINARY RESULTS AND DISCUSSION

In 2008, 14 adult Pacific lamprey were radio tagged (Table 6) to study movements within the lower Deschutes River Sub-basin to determine over-winter and spawn locations. High water and low temperatures from record snowpack limited collection for radio tagging in 2008. Lamprey redd surveys were conducted in 9.7 rkms (rkm 9.7 to rkm 0) of Shitike Creek from 17 April – 25 July. A total of 14.4 rkms were surveyed in Beaver Creek from 22 April – 22 October.

Movement Patterns
Of the 14 lamprey radio tagged in 2008, all were coded upon release. As in previous years, lamprey (N = 1) moved into tributaries prior to over-wintering. Currently, seven lamprey are over-wintering within 3 rkm of LBH (2.1 to 145.3 rkm, Table 6; Figure 3) and two moved downstream of LBH (16.2 to 49.0 Rkm). Downstream movement has occurred in previous years and is not considered unusual. Four traveled more than 20 rkms with one moving into the Warm Springs River, traveling a total of 77.2 rkms prior to overwintering.

One lamprey (No. 126) is over-wintering downstream of the Beaver Creek-Warm Springs River confluence. Post tagging this lamprey moved upstream passing the WSNFH on 8 September and the Island fixed site on 25 September 2008. It resided approximately 0.5 miles upstream of Beaver Creek and Warm Springs River confluence for 66 days prior to moving downstream to its current location.

Lamprey No. 129 was detected on the Warm Springs River fixed site (WSMFS) 28 August 2008. It is currently over-wintering upstream of the WSMFS in the mainstem Deschutes River at rkm 145.3.

Although the size of the Deschutes River prohibits pinpointing exact locations for each individual, lamprey appeared to hold in fast water (White River Rapids, Oak Springs Rapids, Boxcar Rapids) or tailout areas in the main stem. Lamprey in the tributaries appear to over-winter in riffles and glides.

Table 5. Variables measured during redd surveys in Shitike and Beaver creeks, 2008.

Variable	Instrument	Description
Redd dimensions (cm)	Meter stick	Length, width, and depth measured
Water velocity	Marsh-McBarney Flo-Mate	Recorded 5 cm from substrate and at 60% depth for head, middle, and tail of redd
Water depth	Meter stick	Measured at head, middle, and tail of redd
Substrate type	Visual estimate	Percent composition of substrate at head, middle, and tail of redd
Water temperature	Handheld thermometer	One reading before and after survey
Distance to adjacent redds	Surveyors tape	Measurement is taken at head of redd
Spawning area	Visual estimate	Total area available
Substrate composition	Handheld ruler	Pebble counts
Channel type	Visual estimate	Alcove, riffle, glide, pool, and rapid
Average water depth	Meter stick	
Bankfull width	Surveyors tape	
Wetted channel width	Surveyors tape	
Riparian composition	Visual estimate	
Percent canopy cover	Densiometer	

Table 6. Over-winter locations and distance moved from Lower Blue Hole (tagging site) in the lower Deschutes River Sub-basin as of December 2008.

Tag Date	Tag Code	Over-winter location (Rkm)	Distance from Lower Blue Hole (rkm)
7/21/08	124	28.3	-49.0
7/22/08	125[1]		
7/23/08	126	154.5[2]	77.2
7/23/08	127	61.1	-16.2
7/24/08	128	79.4	2.1
7/24/08	129	145.3	68.0
7/26/08	130	106.1	28.8
7/26/08	131	79.4	2.1
7/26/08	132	76.3	-1.0
8/5/08	133	77.1	-0.2
8/5/08	134	100	22.7
8/29/08	135	76.6	-0.7
8/29/08	136	77.4	0.1
9/18/08	137	77.4	0.1

[1] Hasn't been detected since 28 July.
[2] Lamprey No. 126 over-wintering in the Warm Springs River at Rkm 19.3, (mouth of Warm Springs River is Rkm 135.2 on the Deschutes River).

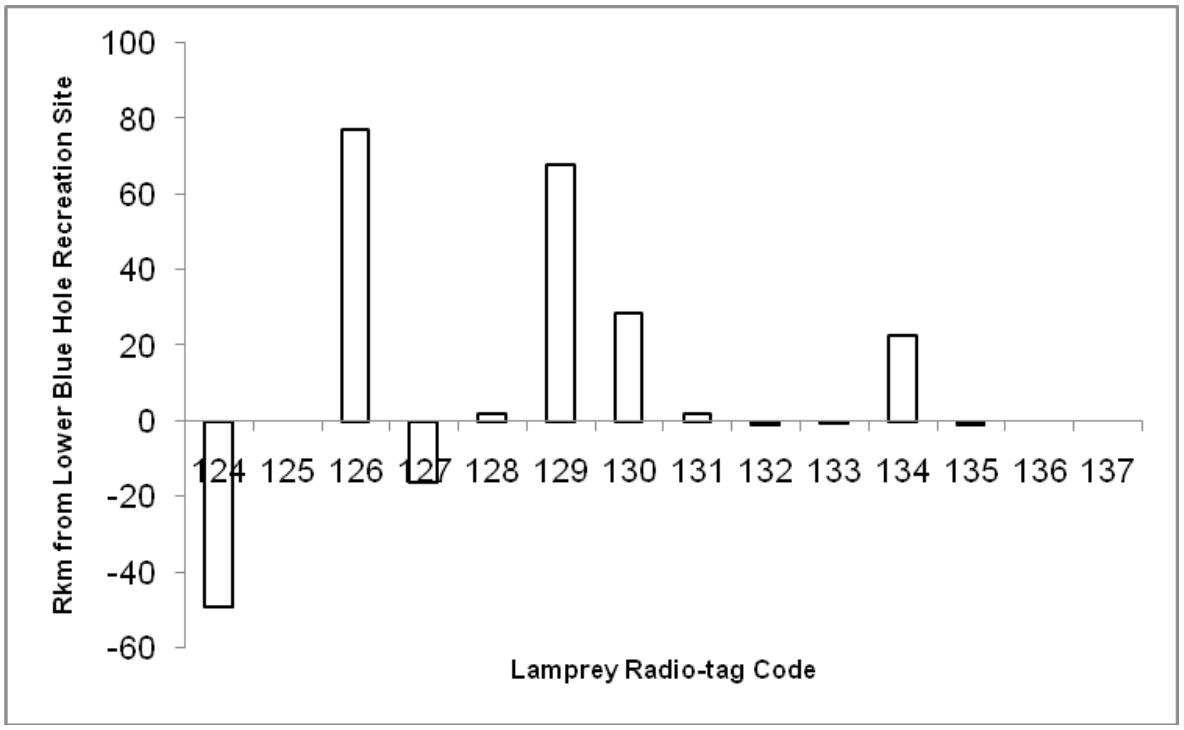

Figure 3. Distance radio-tagged lamprey moved from Lower Blue Hole to overwinter, 2008.

Spawning sites

Although tributary entry of Pacific lamprey was not observed from radio-tagged lamprey, survey crews positively identified redds in Shitike and Beaver creeks. Seventeen redds were counted in Shitike Creek with the peak occurring in late June (Table 7; Figure 4). Water temperature ranged from 9.1 to 14.2ºC during the spawning period in Shitike Creek (Figure 4). Spring/summer surveys conducted in Beaver Creek identified four redds, three of which were

Table 7. Monthly summary of redd counts in Shitike (S) and Beaver (B) creeks.

Reaches	April	May	June	July	Total Redds
S1	0	0	5	1	6
S2	0	0	6	0	6
S3	0	0	3	2	5
B1	0	0	2	1	3
B2	0	0	1	0	1
Totals	0	0	17	4	21

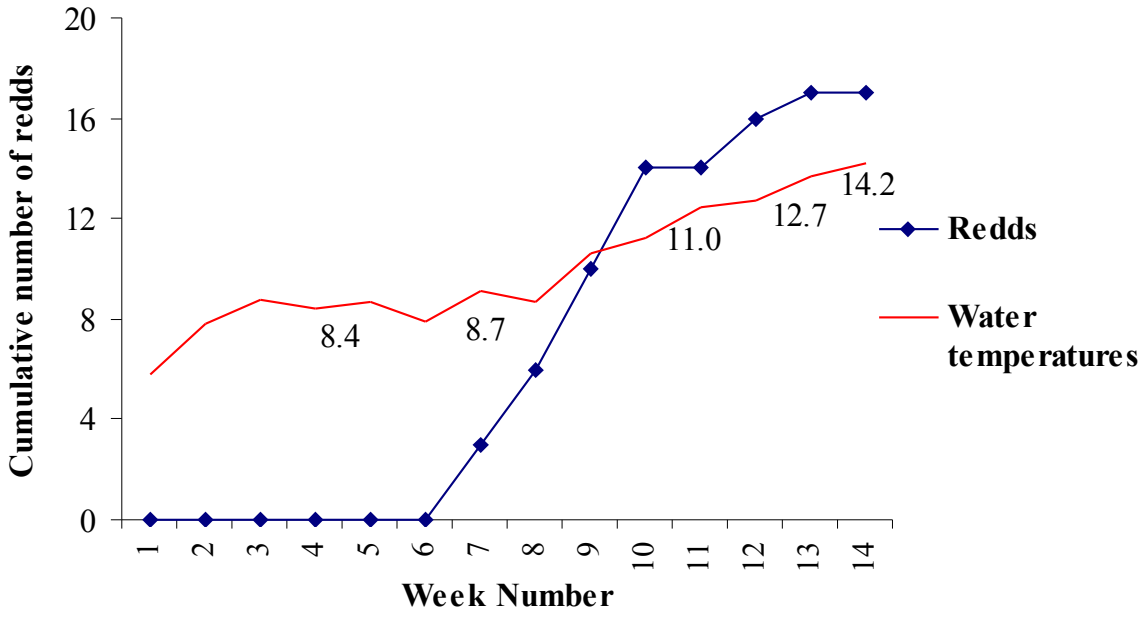

Figure 4. Cumulative redd count and average water temperature in Celsius by week, Shitike Creek 2008.

located in mid June with an average water temperature of 11.5°C. Fall surveys in the lower eight rkm of Beaver Creek from August through October produced zero redds.

Radio Tracking

In 2009, lamprey will continue to be tracked through the spawning period. Redd surveys in Shitike Creek and Beaver Creek begin April 2009. An additional 3.2 rkms in Beaver Creek will be surveyed as it is likely spawning is occurring within this area. Lamprey radio telemetry and habitat data will be analyzed during fall/winter 2009. Over-wintering and spawning habitat (2008 through 2010) will be included in 2009 -2010 annual report.

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Appendix A: Recaptured adult Pacific lamprey movement rates from Buckhollow Landing to Sherars Falls, lower Deschutes River 2008.

Appendix A; Table 1. Recaptured adult Pacific lamprey movement rates from Buckhollow Landing to Sherars Falls, lower Deschutes River 2008.

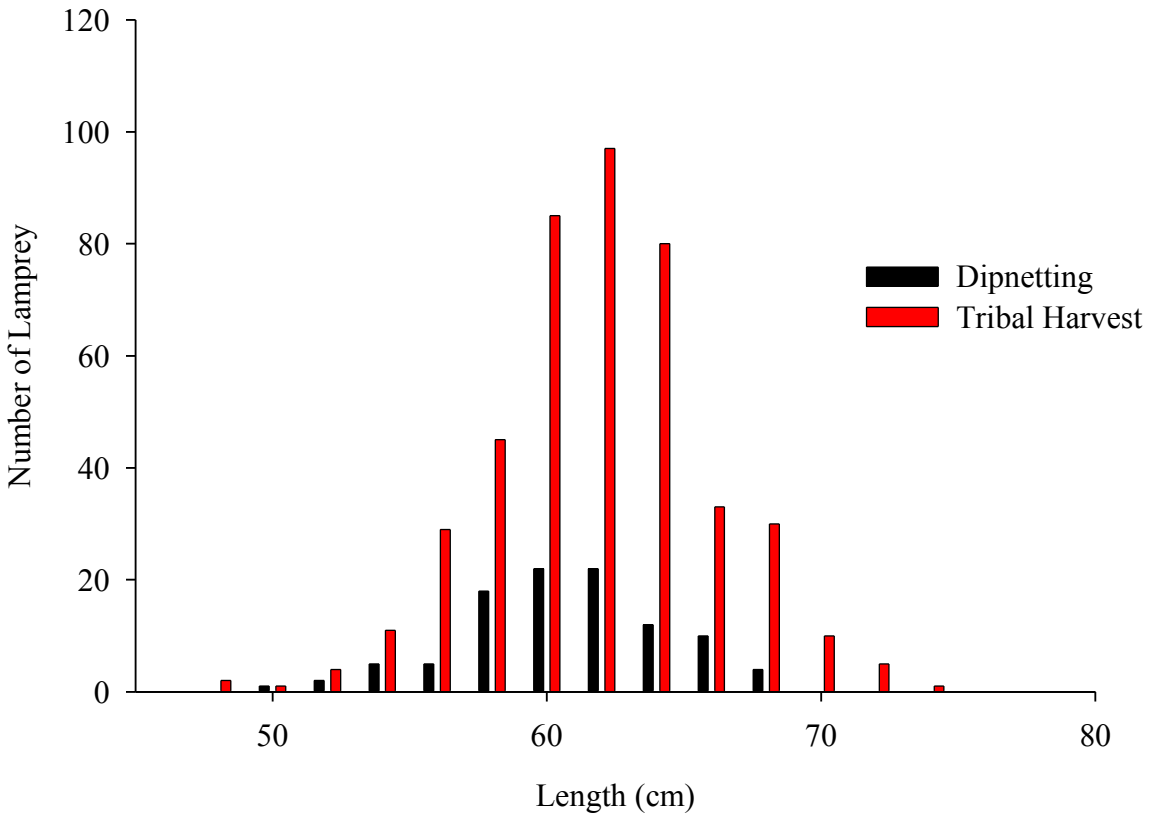
Mark Date	Tag No.	Length (cm)	Girth (cm)	Recapture Date	Days to Return	Movement Rate (Rkm/day)
7/21/08	5001 [1]	61.0	9.5	7/26/08		
7/21/08	5005	63.5	10.0	7/28/08	6.94	3.47
7/23/08	5007	61.0	10.0	7/28/08	4.92	2.46
7/25/08	5017	58.5	9.5	7/28/08	3.10	1.55
8/11/08	5028	64.0	10.0	8/12/08	0.88	0.44
8/12/08	5041	58.5	9.0	8/13/08	0.98	0.49
8/12/08	5040	54.0	8.0	8/28/08	15.98	7.99
8/15/08	5052	68.5	10.0	8/25/08	10.02	5.01
8/16/08	5058	63.0	10.0	8/25/08	8.94	4.47
8/23/08	5068	61.0	10.0	9/5/08	13.04	6.52
8/27/08	5089	58.0	9.0	9/5/08	9.02	4.51
9/2/08	5102	53.0	8.0	9/3/08	1.01	0.51
9/2/08	5103	62.5	9.5	9/8/08	7.98	3.99
9/4/08	5110	61.5	9.0	9/5/08	1.06	0.53
9/4/08	5111	63.0	8.5	9/5/08	1.06	0.53

[1]No data captured.

Appendix B: Adult Pacific Lamprey Length Statistics and Frequencies in the lower Deschutes River, Sherars Falls, 2008.

Appendix B; Table 1. Length (cm) statistics for adult Pacific Lamprey collected at Sherars Falls through dipnetting and tribal harvest, 2008.

	Marked Lamprey	Harvested Lamprey
Sample Size	101	433
Mean Length (cm)	61.3	62.3
Standard Deviation	3.71	3.99
Standard Error	0.369	0.192
C.I. Of Mean	0.733	0.377
Max Length	68.5	74.0
Min Length	51.5	48.0
Median Length	61.5	62.0
Skewness	-0.356	-0.045
Kurtosis	0.029	0.489
K-S Distribution	0.078	0.075
K-S Probability	0.130	<.001



Appendix B; Figure 1. Length frequency for adult Pacific lamprey collected through dipnetting and tribal harvest at Sherars Falls, 2008.