Document ID #P102687

EVALUATE STATUS OF PACIFIC LAMPREY IN THE CLEARWATER RIVER AND SALMON RIVER DRAINAGES, IDAHO

ANNUAL REPORT
2006

Prepared by:
Matthew W. Hyatt, Fishery Technician
Christopher Claire, Fishery Research Biologist
Tim Cochnauer, Sr. Fishery Research Biologist

Idaho Department of Fish and Game
P.O. Box 25
Boise, ID 83707

Prepared for:
U.S. Department of Energy
Bonneville Power Administration
Environmental Fish and Wildlife
P.O. Box 3621
Portland, OR 98203-3621

Project Number 2000-028-00
Contract Number 00000090-00001

TABLE OF CONTENTS

Page

ABSTRACT 1
INTRODUCTION 2
STUDY AREA 3
OBJECTIVES 6
METHODS 7
RESULTS 10
DISCUSSION 28
ACKNOWLEDGEMENTS 34
LITERATURE CITED 35
APPENDICES 39

LIST OF TABLES

Table 1. Number of sites sampled and the number of sites where Pacific lamprey ammocoetes were collected in the Clearwater and Salmon river drainages, ID. 1

Table 2. Abundance trend surveys of Pacific lamprey ammocoetes in Red River, ID, 2001, 2003-2006. 15

Table 3. Abundance trend surveys of Pacific lamprey ammocoetes in S. F. Clearwater River, ID, 2001-2006. 16

Table 4. Abundance trend surveys of Pacific lamprey ammocoetes in the Lochsa River, ID, 2002-2006. 17

Table 5. Abundance trend surveys of Pacific lamprey ammocoetes in the Selway River, ID, 2002-2006. 17

Table 6. Abundance trend surveys of Pacific lamprey ammocoetes in the mainstem Salmon River above the S.F. Salmon River and between the S.F. Salmon River and the Little Salmon River, ID, 2003-2006. 24

Table 7. Abundance trend surveys of Pacific lamprey ammocoetes in the mainstem Salmon River below the Little Salmon River, 2003-2006, and in the M.F. Salmon River, 2005-2006, ID. 25

Table 8. Length-weight regression equations for Pacific lamprey ammocoetes and macropthalmia collected by electroshocking in Clearwater and Salmon River drainages, ID, 2000-2006. 28

LIST OF TABLES, Continued

Page

Table 9. Pacific lamprey accessible drainage area 1850 and 2006, and occupied stream km's 1960 and 2006 for 4'th and greater order and selected 3'rd order streams in the Snake River subbasin, ID, OR, WA. Historical distribution based on Gilbert and Evermann (1894), Keating (1958), and Scott and Crossman (1998). 32

LIST OF FIGURES

Figure 1. Location of Pacific lamprey studies in the Clearwater, Salmon, and Snake river drainages, ID, 2000-2006. 4

Figure 2. Pacific lamprey adult upstream passage at Lewiston Dam 1950-1972, Clearwater River drainage, ID. 5

Figure 3. Location of investigations and Pacific lamprey distribution in the Clearwater River drainage, ID, 2000-2006. Circles indicate general sample locations with closed circles indicating sites of Pacific lamprey ammocoete observations. 8

Figure 4. Pacific lamprey adult upstream passage 1938-2006, Bonneville Dam, OR (USACE 2006). 12

Figure 5. Pacific lamprey adult upstream passage 1962-2006, Ice Harbor Dam, WA (USACE 2006). 12

Figure 6. Pacific lamprey adult upstream passage (day and night) 1995-2006, Lower Granite Dam, WA (USACE 1995-2006). Regression analysis was used to predict night counts for 2003-2006 (when night counts were not collected) using the equation, night count = 5.7(day count) – 44.5 (R^2 = 0.71). 13

Figure 7. Length frequencies of Pacific lamprey ammocoetes captured at Red River rotary screen trap at rkm 5.0, 2006. 13

Figure 8. Length frequencies of Pacific lamprey ammocoetes collected by electroshocking in Red River, 2000, 2002, 2004, and 2006. 14

Figure 9. Minimum, maximum, and mean total length (mm) of Pacific lamprey ammocoetes collected by electroshocking in the Clearwater River drainage, ID, 2000-2006. 19

LIST OF FIGURES, Continued

Page

Figure 10. Length frequencies of Pacific lamprey ammocoetes collected by electroshocking in S.F. Clearwater River, 2000, 2002, 2004 and 2006. 20

Figure 11. Length frequencies of Pacific lamprey ammocoetes collected by electroshocking in the Selway River, 2002, 2004, and 2006. 21

Figure 12. Length frequencies of Pacific lamprey ammocoetes collected by electroshocking in the Lochsa River, 2002, 2004, and 2006. 22

Figure 13. Pacific lamprey captured (N=496) in NPTF rotary screen trap Lolo Creek (rkm 21.0) 1994-2006, Clearwater River watershed, ID (Sprague and Johnson 2006). 22

Figure 14. Location of Pacific lamprey investigations and distribution in the Salmon River drainage, ID, 2003-2006. 23

Figure 15. Minimum, maximum, and mean total length (mm) of Pacific lamprey ammocoetes collected by electroshocking the Salmon River drainage, ID, 2004-2006. 26

Figure 16. Length frequencies of Pacific lamprey ammocoetes captured by electroshocking in main Salmon River, 2004-2006. 27

Figure 17. Length frequencies of Pacific lamprey captured by electroshocking in the M.F. Salmon River, 2005-2006. 27

Figure 18. Length-weight relationships for Pacific lamprey ammocoetes captured by electroshocking (all available years data combined). 29

LIST OF APPENDICES

Appendix A. Pacific lamprey length and weight information from Red River, ID, 2006…….. 40

Appendix B. Pacific lamprey length and weight information from S.F.Clearwater River, ID, 2006……..... 41

Appendix C. Pacific lamprey length and weight information for M.F. Clearwater River, ID, 2006……. 44

LIST OF APPENDICES, Continued

Page

Appendix D. Pacific lamprey length and weight information for Selway River,ID, 2006. 45

Appendix E. Pacific lamprey length and weight for Lochsa River, ID, 2006 48

Appendix F. Pacific lamprey length and weight information for mainstem Salmon River, ID, 2006….. 51

Appendix G. Pacific lamprey length and weight information for M.F. Salmon River, ID, 2006…….. 56

Appendix H. Pacific lamprey population trend and surveys in Red River, S.F. Clearwater River watershed, ID, 2006..... 59

Appendix I. Pacific lamprey population trend and survey habitat descriptors, Red River, S.F. Clearwater River watershed, ID, 2006..... 59

Appendix J. Pacific lamprey population trend and surveys in S.F. Clearwater River watershed, ID, 2006. 60

Appendix K. Pacific lamprey population trend and survey habitat descriptors, S.F. Clearwater River watershed, ID, 2006. 60

Appendix L. Pacific lamprey population trend and surveys in Selway River watershed, ID, 2006…….. 60

Appendix M. Pacific lamprey population trend and survey habitat descriptors, in Selway River watershed, ID, 2006..... 61

Appendix N. Pacific lamprey population trend and surveys in Lochsa River watershed, ID, 2006…….. 61

Appendix O. Pacific lamprey population trend and survey habitat descriptors, in Lochsa River watershed, ID, 2006..... 62

Appendix P. Pacific lamprey population trend and surveys in mainstem Clearwater River drainage, ID, 2006..... 62

Appendix Q. Pacific lamprey population trend and survey habitat descriptors,in mainstem Clearwater River drainage, ID, 2006. 62

Appendix R. Pacific lamprey surveys in mainstem Salmon River drainage, ID, 2006……. 63

Appendix S. Pacific lamprey survey habitat descriptors in Salmon River drainage, ID, 2006……..... 64

LIST OF APPENDICES, Continue

Page

Appendix T. Pacific lamprey surveys in M.F. Salmon River watershed, ID, 2006. 65

Appendix U. Pacific lamprey survey habitat descriptors in M.F. Salmon River watershed, ID, 2006…….. 65

Appendix V. Pacific lamprey surveys in E.F. Salmon River, Pahsimeroi River, and Lemhi River watersheds, ID, 2006. 66

Appendix W. Pacific lamprey surveys in E.F. Salmon River, Pahsimeroi River, and Lemhi River watersheds, ID, 2006. 66

Appendix X. Waters surveyed in the Clearwater and Salmon River drainages and presence or absence of Pacific lamprey. 67

ABSTRACT

Pacific lamprey *Lampetra tridentata* is a native Snake River subbasin anadromous fish species occupying a unique ecological niche. Recent decline of Pacific lamprey adult migrants to the Snake River subbasin has contributed to focused attention on the species. Pacific lamprey adults counted passing Ice Harbor Dam fishway (first hydroelectric facility on Snake River) averaged 18,000 during 1962-1969 and about 600 during 1993-2006. Human manipulations of natural resource in the Snake, Clearwater, and Salmon river drainages have altered habitat characteristics of ecosystems in these basins in the last 120 years, impacting the productive potential of Pacific lamprey habitat. Timber harvest, stream impoundment, road construction, grazing, mining, and community development have dominated habitat alteration in the Clearwater, Salmon, and Snake river systems in Idaho. Hydroelectric projects in the Snake River migratory corridor impact Pacific lamprey outmigrants and returning adults. The Pacific Power and Light Lewiston Dam on the Clearwater River at Lewiston, Idaho (1927-1972), Dworshak Dam on the N.F. Clearwater River (1972-present), and Harpster Dam on the S.F. Clearwater River (1910-1963), severely or completely restricted Chinook salmon *Oncorhynchus tshawytscha* passage and altered or obstructed passage routes of outmigrating Pacific lamprey ammocoetes, macropthalmia, and upstream adult migrants. Sunbeam Dam constructed on the mainstem Salmon River immediately upstream of the Yankee Fork of the Salmon River in 1910, obstructed salmon *O. spp.,* summer steelhead trout *O. mykiss,* and Pacific lamprey to an unknown degree until removal in 1934. Prior to 1910 the majority of Snake River basin tributaries upstream of Hells Canyon in southeastern Oregon and southwestern Idaho were accessible to anadromous species. In the period from 1910 to 1967 numerous Bureau of Reclamation irrigation impoundments and private and public hydroelectric projects were completed, and culminated with the construction of the Idaho Power Company Hells Canyon Complex (1958-1967). These impoundments have altered Snake River flow regimes, impacted nutrient transport, and relegated anadromous accessibility in the basin to the Snake River Hells Canyon reaches downstream of Hells Canyon Dam and the lower Snake River.

In 2006 Idaho Department of Fish and Game continued investigations into the status of Pacific lamprey populations in Idaho's Clearwater and Salmon river drainages. Electroshocking and visual habitat assessment surveys were used to determine Pacific lamprey distribution, life history strategies, habitat requirements, and population abundance in the S.F. Clearwater River, Red River, Lochsa River, Selway River, M.F. Clearwater River, mainstem Clearwater River, mainstem Salmon River, Little Salmon River. M.F. Salmon River, and S.F. Salmon River watersheds. Eight-hundred and seventy-one ammocoetes and macropthalmia were captured through electroshocking of 136 sites in these streams and their tributaries in 2006. Findings in 2006 augment 2000-2005 surveys consistently indicating Pacific lamprey ammocoetes and macropthalmia are not numerous or widely distributed in Idaho river basins. Pacific lamprey distribution was confined to the lower reaches of Red River below rkm 7.5, the S.F. Clearwater River, Lochsa River (Weir Creek to mouth), Selway River (Bear Creek to mouth), M.F. Clearwater River, the Clearwater River, the mainstem Salmon River downstream of the N.F. Salmon River, and the M.F. Salmon River (rkm 78.7 to mouth).

INTRODUCTION

The Pacific lamprey *Lampetra tridentata* is facing the same migratory hazards and habitat degradation as other anadromous fish species in Idaho. Because this fish is not recognized as a sport or game fish species, little attention has been given to its status. Records documenting Pacific lamprey presence historically in Idaho are relatively rare. Gilbert and Evermann (1894) identified the species upstream distribution limit in the Snake River near Shoshone Falls. Idaho Department of Fish and Game (IDFG) personnel captured Pacific lamprey ammocoetes in the out-migrant anadromous juvenile fish traps near Brownlee Dam in the late 1950's (Bell 1959). Limited anecdotal information indicates Pacific lamprey occupied the majority of major river drainages in the western Snake River subbasin upstream of Hells Canyon prior to European settlement, including the Payette and Weiser River watersheds. Pacific lamprey adult upstream passage was monitored at the Clearwater River Pacific Power and Light Lewiston Dam during the 1953-1972 period, however, after 1956 no Pacific lamprey adults were documented at the dam with the exception of 2 individuals in 1968.

The ecological trophic interaction of Snake River Pacific lamprey populations and other riverine species contributes to Snake River subbasin overall aquatic productivity. Pacific lamprey ammocoetes provide Snake River subbasin white sturgeon *Acipenser transmontanus* with an important food source (Galbreath 1979) contributing to population productivity. Pacific lamprey adults are a source of marine derived nutrients in the Snake River subbasin. Aquatic and avian predator utilization of ammocoetes and macropthalmia (Merrel 1958) potentially results in reduced predation impact to out-migrating juvenile salmon *Oncorhynchus spp*. and steelhead trout *O. mykiss* in the lower Snake River and Columbia River migrational corridor. Pacific lamprey, Chinook salmon *O. tshawytscha*, and summer steelhead trout, rear collectively in Snake River subbasin stream habitats, however, little is known of the ecological interactions between the three species within the basin and the ecological impacts of Pacific lamprey declines since 1965.

Habitat degradation in Columbia River basin and Snake River subbasin Pacific lamprey spawning and rearing streams associated with mining, livestock grazing, stream channelization, logging, road construction, and urbanization in combination with hydroelectric impacts in the migratory corridor cumulatively have been implicated as the major factors contributing to Pacific lamprey declines (Close et al. 1995; Jackson et al. 1996; Jackson et al. 1997). Hydroelectric dam upstream passage ladders are difficult structures for Pacific lamprey upstream migrants to navigate (Vella et al. 1997).

Pacific lamprey ammocoetes are eyeless upon hatching and filter feed 4-7 years before undergoing transformation into macropthalmia. Transformation changes include formation of an oral disc and eyes among other morphological processes. Following transformation into macropthalmia, Pacific lamprey migrate to the ocean and begin to feed parasitically on a wide range of aquatic marine organisms (Scott and Crossman 1998) including Pacific herring *Clupea pallasii*, Pacific hake *Merluccius productus*, walleye pollock *Theragra chalcograma*, salmon, and steelhead trout among others for an estimated 1-2 years prior to returning to freshwater to complete their life cycle. These fish enter Idaho streams in late summer and early fall and spawn the following spring.

The Clearwater River drainage of north central Idaho is an important study area as both Pacific lamprey ammocoetes and macropthalmia have been captured in S.F. Clearwater River anadromous fish smolt traps since 1992. Both historical data and anecdotal accounts document

that Pacific lamprey were also present in throughout the Salmon River drainage. Understanding Pacific lamprey ammocoete and macropthalmia population composition, migrational behavior, habitat needs, and distribution in the Clearwater and Salmon river drainages will provide basic information to better manage Pacific lamprey. This project continues to augment our knowledge of Pacific lamprey and provide critical information to minimize future degradation of habitat and effectively conserve a species in decline.

STUDY AREA

The Clearwater River drainage is located in north central Idaho and encompasses approximately 2.5 million hectares (Figure 1). The major tributaries include the Potlatch, S.F. Clearwater, N.F. Clearwater, M.F. Clearwater, Selway, and Lochsa rivers.

Hydroelectric dam construction in the Clearwater River drainage has impacted salmon, steelhead trout, and Pacific lamprey populations. The Pacific Power and Light Lewiston Dam, was constructed in 1927 at Clearwater River rkm 4.6. The dam was originally constructed with two upstream passage ladders, but obstructed steelhead trout passage somewhat and salmon passage severely. In the 1927-1940 period when the problem was detected and remedied, spring Chinook salmon and fall Chinook salmon populations were reduced to remnant numbers and subsequently never fully recovered (White 1954). The impacts of the Lewiston Dam to Pacific lamprey macropthalmia and ammocoete downstream migrants and upstream migrating adults are unknown, however, upstream migrant anadromous species counts documented the presence of adult Pacific lamprey returning to the drainage (Figure 2). Dworshak Dam, constructed in 1972 on the N. F. Clearwater River (rkm 3.1) is without an upstream passage ladder. As a result of the reservoir's length (86.9 km), depth (198 m maximum depth) and limited flow velocities through the reservoir in critical migratory periods, it is unlikely juvenile anadromous species outmigrations would have ever successfully occurred even if adults had navigated over the project and spawned in tributaries upstream of the dam. Anadromous fish populations upstream of the project are now considered extirpated. Harpster Dam, constructed in 1910 on the S.F. Clearwater River, blocked the upstream migration of anadromous fish from 1949 to 1963; however, the impact on the Pacific lamprey population is unknown. High flows destroyed the fishway in 1949 eliminating adult salmonid passage until the dam was removed in 1963. Adult Pacific lamprey passage may have occurred during this entire period as adult Pacific lamprey have the ability to climb above water surface levels. Pacific lamprey returns following removal of the dam have provided recolonization stock for the S.F. Clearwater River drainage.

The land ownership of the Clearwater River drainage is U. S. Forest Service, Bureau of Land Management, and other federal Lands (58.0%), State of Idaho (6.0%), Nez Perce Tribe (4.0%), and private (32.0%). Land use in the Clearwater River drainage is primarily agricultural or livestock pasture grazing in the lower and central basin and forestry related in the headwater reaches.

The S.F. Clearwater River drains 300,440 hectares. The upper S.F. Clearwater River watershed has several large meadow complexes with low stream gradients and fine substrates. The mid and lower S.F. Clearwater River reaches are predominantly canyon confined and boulder substrate dominated. The current land ownership of the S.F. Clearwater River watershed is federal (70%), private (28%), Nez Perce Tribe (0.9%), and State of Idaho (0.7%).

Figure 1. Location of Pacific lamprey studies in the Clearwater, Salmon, and Snake river drainages, ID, 2000-2006.

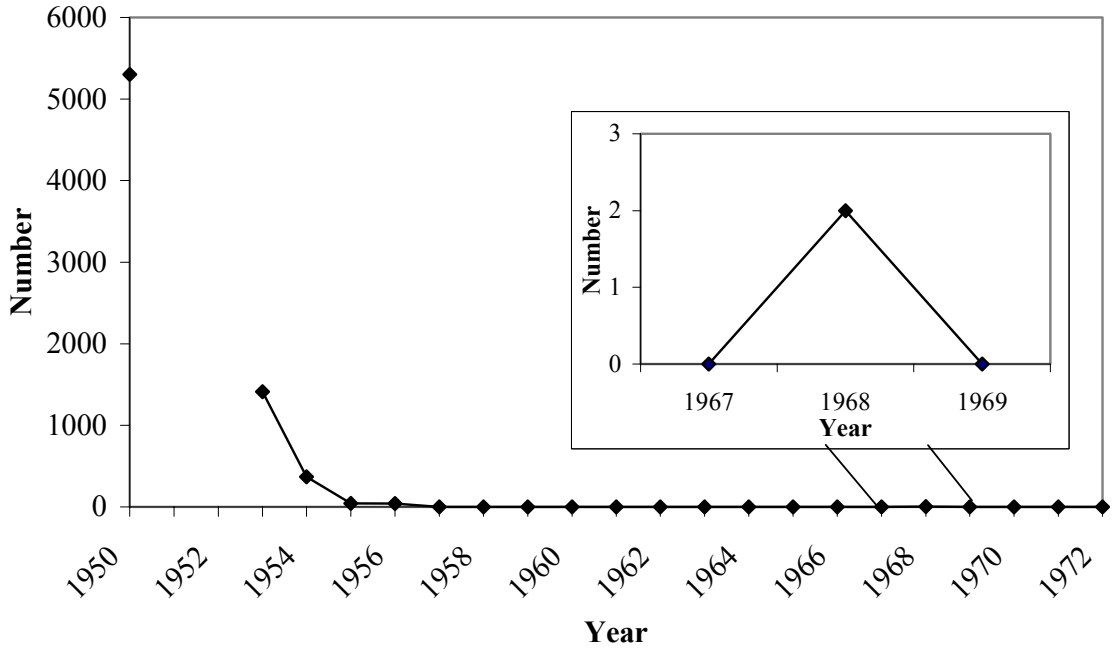

Figure 2. Pacific lamprey adult upstream passage at Lewiston Dam 1950-1972, Clearwater River drainage, ID.

Extensive mining from the 1860's to the mid-1900's occurred in four S.F. Clearwater River tributaries: Crooked River, Red River, American River, and Newsome Creek.

The Salmon River is the largest watershed (3,652,850 ha) in the Snake River subbasin with anadromous species access to the Pacific Ocean (Figure 1). The largest tributary, the M.F. Salmon River, largely emanates from the Frank Church River of No Return Wilderness which is 849,858 ha, 23.3% of the Salmon River drainage area. The current land ownership of the Salmon River drainage is U.S. Forest Service (75.6%), private (17.0%), Bureau of Land Management (6.8%), State of Idaho (0.5%), and other (0.1%).

The mainstem Salmon River originates from the Sawtooth mountain range near Stanley, ID, and runs north northwesterly 660 km meeting the Snake River at rkm 304. Hydroelectric facility construction on Salmon River drainage streams has historically been limited to two sites, the mainstem Lemhi River power diversion structure at the town of Salmon, ID, and Sunbeam Dam upstream of the Yankee Fork of the Salmon River. The Lemhi River diversion structure was a lowhead structure with an upstream passage ladder. However, it obstructed salmon and steelhead trout passage somewhat by disorienting migrants due to dewatering of the mainstem Lemhi River channel downstream of the diversion and offsite outflow of the power plant into the main Salmon River several kilometers below the confluence of the two streams. The impact of the project to Pacific lamprey adult migrants destined for the Lemhi River watershed is unknown. In 1910 the Sunbeam Consolidated Gold Mines Company constructed a hydroelectric power plant immediately upstream of the Yankee Fork of the

Salmon River on the mainstem Salmon River. The structure was 10.7 m in height and spanned 29.0 m. Construction of a wooden upstream passage ladder was completed in 1911; however, the passage efficiency of the ladder was questionable due to construction design. In April 1911 the Sunbeam mill and mine, which were the impetus for construction of the dam, were closed due to limited value of the ore extracted from the mine. In 1920 a concrete ladder was constructed and sockeye salmon *O. nerka* passage was documented several years in the 1920-1929 period. However, following initial construction of Sunbeam Dam until 1934, salmonid passage over the structure was less than desirable and upper mainstem Salmon River stocks were impacted to a documentable degree. In 1934 the Sunbeam Dam was partially removed through the use of explosives in response to the need to further improve upstream anadromous migrant passage. Pacific lamprey passage likely occurred to a limited degree through the fishway and river tunnel in the 1911 to 1934 period.

Trapping of furbearing species including beaver *Castor canadensis* in the Salmon River drainage was extensive in the 1811-1845 period (Lichatowich 1999). These efforts greatly reduced beaver populations throughout the drainage resulting in a basinwide reduction in the quantity of stream pool/wetland aquatic habitat, which resulted in a notable negative impact to anadromous species in the basin (Lichatowich 1999). Current land use activities in the Salmon River drainage are predominantly livestock grazing in the lower basin and Lemhi River watershed, with forestry in the mountainous terrestrial habitats throughout the drainage. Timber harvest with associated road construction and subsequent road mass-wasting failure, impacted the S.F. Salmon River Chinook salmon productive capacity severely from 1965-1980's. Mining in the lower and mid-reaches of the Salmon River drainage was initiated in the 1860's utilizing primarily hydraulic placer, rocker, and sluice methods. In the 1920-1960 period Warren Creek and Yankee Fork of the Salmon River drainages were extensively bucket-dredged mined resulting in stream channel destabilization and construction.

OBJECTIVES

1. Determine life history characteristics of Pacific lamprey ammocoetes and macropthalmia in the S.F. Clearwater River watershed.

2. Determine habitat requirements of Pacific lamprey throughout the Clearwater River drainage.

3. Determine distribution and monitor population status of Pacific lamprey in Clearwater and Salmon river drainages.

4. Determine feasibility of enhancing population in Clearwater River drainage addressing disease and genetic compatibility concerns.

5. Initiate development of Pacific lamprey conservation management criteria for implementation in the Clearwater and Salmon river drainages.

METHODS

Electroshocking techniques with an ABP-2 dual channel electrofisher were used to capture fish in stream channels. Surveys were conducted in the Red River, S.F. Clearwater River, Selway River, Lochsa River, Potlatch River, mainstem Clearwater River, M.F. of the Clearwater River, M.F. Salmon River, Lemhi River, E.F. Salmon River, N.F. Salmon River, mainstem Salmon River, and other selected tributaries (Figure 3, Table 1). Sampling was initially conducted in the S.F. Clearwater River watershed in 2001 and expanded into the M.F. Clearwater River, Lochsa River, Potlatch River, and Selway River watersheds in 2002-2004. Since 2004 electroshocking surveys in the Red River, S.F. Clearwater River, Lochsa River, Selway River, and M.F. Clearwater River have primarily been to assess population trends through resampling of established known occupied sites based on 2002-2004 work. In 2004-2006 extended monitoring surveys were utilized to attempt to identify Pacific lamprey distribution in tributaries and reaches of the S.F. Clearwater River, Red River, Lochsa River, Selway River, and M.F. Clearwater River where sampling had failed to locate Pacific lamprey previously. In 2003 surveys were initiated in the Salmon River subbasin.

Pacific lamprey habitat utilization characteristics provided guidance for site selection criteria during 2001-2006 surveys and establishment of population trend monitoring sites (Claire 2003). Three downstream migrant traps currently operated by IDFG in the S.F. Clearwater River drainage were used to monitor Pacific lamprey downstream movements throughout the study. The Crooked River scoop trap (rkm 1.0) was replaced with a 1.50 m rotary screen trap in 2002. It was operated from April 11 to October 31 in 2006. A 1.50 m diameter rotary screen trap on American River (rkm 3.0) was operated from April 11 to October 31. Another 1.50 m diameter rotary screen trap on Red River (rkm 5.0) was operated from March 16 to October 31. Nez Perce Tribal Fisheries (NPTF) operates a 1.50 m rotary screen trap at rkm 21.0 on Lolo Creek and another at rkm 0.1 on Newsome Creek. The Lolo Creek trap is operated 12 months annually, weather permitting. The duration of Newsome Creek trap operations is predominantly in the March to October period annually. Trapping records for the 1994-2006 period were obtained from Nez Perce Tribe biologists (Sprague and Johnson, NPTF 2006) and assessed to determine ammocoete and macropthalmia downstream migration magnitude and timing in the Lolo and Newsome Creek watersheds.

Captured Pacific lamprey ammocoetes and macropthalmia were anesthetized and total lengths and body weights measured. Individuals were then recovered in fresh water and released near the site of capture. Outmigrant estimates at traps were made using trap area-fished methods as described by Beamish and Levings (1991).

Pacific lamprey ammocoete length and weight data was compiled (all available years combined) for each river and used to develop a length-weight regression describing the length-weight relationship of ammocoetes within each individual river. It is common when developing length-weight regressions to determine the minimum total length at which weights are sufficiently reliable to include in the analysis (Murphy et al. 1991). We arbitrarily selected 60 mm TL as the minimum total length to be included in this analysis. Linear regressions of $\log_{10}$weight as a function of $\log_{10}$length were calculated for each sample. For each population, estimated weights were generated for fish 60 mm TL (or for the smallest TL fish in the sample) to fish 180

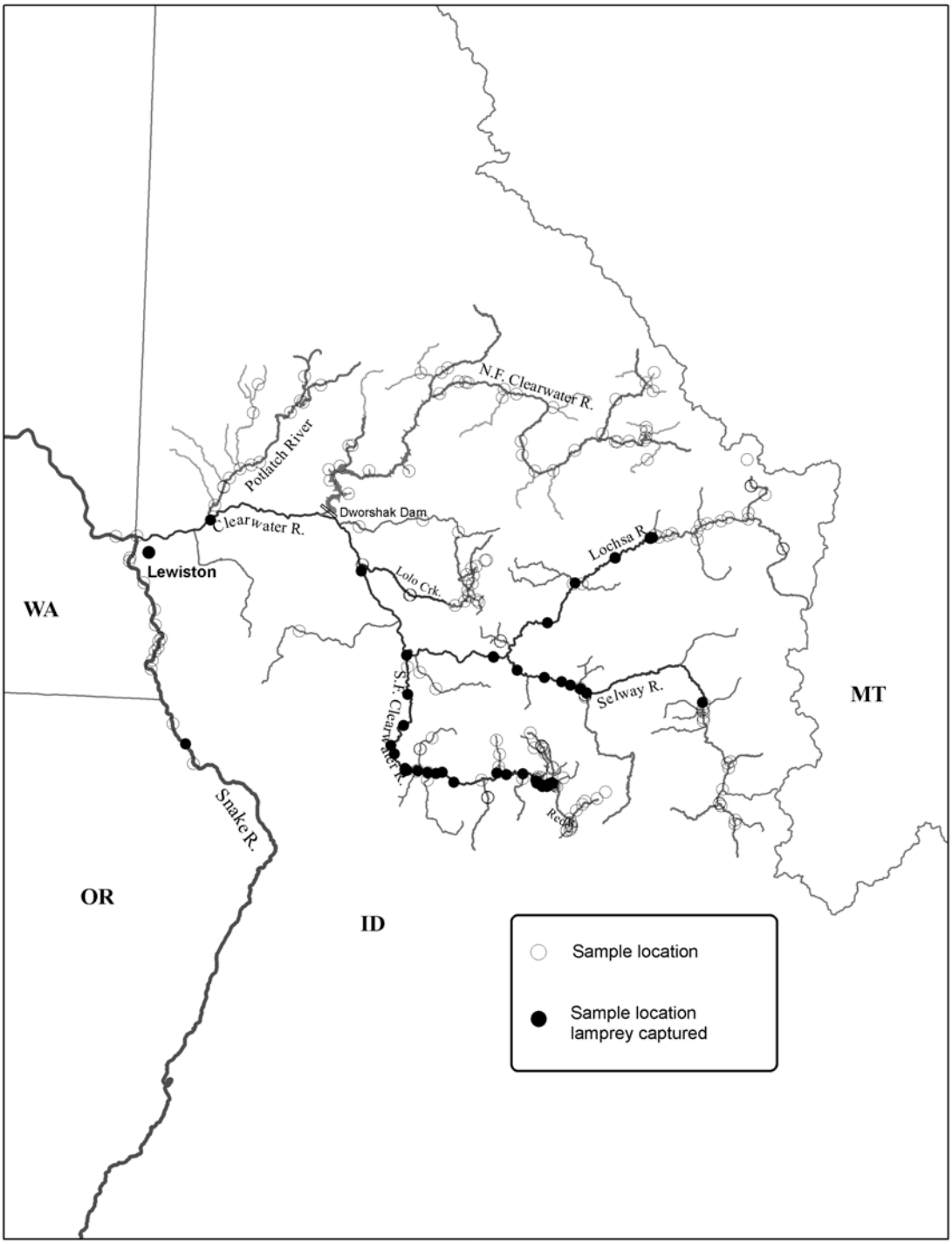

Figure 3. Location of investigations and Pacific lamprey distribution in the Clearwater River drainage, ID, 2000-2006. Circles indicate general sample locations with closed circles indicating sites of Pacific lamprey ammocoete observations.

Table 1. Number of sites sampled and the number of sites where Pacific lamprey ammocoetes were collected in the Clearwater and Salmon river drainages, ID.

CLEARWATER RIVER DRAINAGE																
	2000		2001		2002		2003		2004		2005		2006		Total	
System	TS	SWL	TS	SWL	TS	SWL	TS	SWL	TS	SWL	TS	SWL	TS	SWL	TS	SWL
M.F. Clearwater					4	2	15	2	7	2	11	2	12	2	49	10
S.F. Clearwater	10	0	24	15	14	2	2	2	8	5	10	5	11	4	79	33
N.F. Clearwater									33	0	4	0			37	0
Red River			20	5	13	7	4	4	8	7	12	10	14	4	71	37
Lochsa River					15	4	8	4	12	5	13	5	12	4	60	22
Clearwater			1	1									1	0	2	1
Potlatch River					15	0					3	0	3	0	21	0
Selway River					14	3	11	5	7	5	7	5	9	5	48	23
Snake River					6	1					10	0			16	1
Total	10	0	44	20	82	20	40	17	75	24	70	27	62	19	383	127

SALMON RIVER DRAINAGE																
	2000		2001		2002		2003		2004		2005		2006		Total	
System	TS	SWL	TS	SWL	TS	SWL	TS	SWL	TS	SWL	TS	SWL	TS	SWL	TS	SWL
M.F. Salmon									12	0	30	9	12	6	54	15
Mainstem Salmon							17	4	19	5	55	14	33	13	124	36
Little Salmon							6	0	8	0	2	0	5	0	37	0
Pahsimeroi											2	0	1	0	3	0
Yankee Fork											4	0			4	0
Lemhi											10	0	3	0		
N.F. Salmon											3	0	1	0	4	0
E.F. Salmon											10	0	4	0	14	0
S.F. Salmon									28	0			15	0	43	0
Total							23	4	39	5	126	23	74	19	280	51

TS = Total # of sites sampled SWL= sites with lamprey

mm TL (or the largest fish in the sample) at 1 mm intervals with the back-transformed regression equation calculated for that population (Kruse and Hubert 1997). We then plotted estimated weight (g) as a function of total length (mm) to describe the length-weight relationship for each population.

The Snake River subbasin Pacific lamprey conservation management plan and feasibility of population enhancement will be addressed in separate documents.

RESULTS

See Appendices for sampling locations, survey site habitat descriptors, and individual length and weight information for collected Pacific lamprey ammocoetes and macropthalmia.

In 2006, day-time monitoring efforts of adult Pacific lamprey passage counted 38,931 adults passing Bonneville Dam (Figure 4), 277 adults passing Ice Harbor Dam (Figure 5), and 35 adults passing Lower Granite Dam (Figure 6).

Pacific lamprey distribution in the Clearwater River drainage was limited to lower 7.5 km of Red River, the S.F. Clearwater River, Selway River (Selway Lodge, rkm 82, to mouth), Lochsa River (Weir Creek, rkm 61, to mouth), M.F. Clearwater River, and the Clearwater River (Figure 3). No Pacific lamprey were captured in the Selway River above Selway Lodge, Selway River tributaries, Lochsa tributaries, M.F. Clearwater tributaries, or S.F. Clearwater River tributaries. See appendices for a list of all tributaries sampled.

Individual ammocoetes and macropthalmia were found mostly inhabiting sand and silt substrates in calm water sites often adjacent to overhanging riparian canopy cover or in low velocity areas behind boulders. Pacific lamprey ammocoetes were captured in water depths ranging from 0.1 – 1.0 m, however, they were predominantly captured in depths <0.60 m.

As in 2000-2005, no Pacific lamprey ammocoetes or macropthalmia were captured in the Crooked River or American River rotary screen traps in 2006. Twenty-eight ammocoetes and one macropthalmia were captured in the Red River rotary screen trap in 2006 (Figure 7) from April 12 to June 15. The Red River trap was fished from April 11 to October 31 (B. Bowersox, IDFG, personal communication). Based on trap-area and time fished, a total of 196 ammocoetes and 7 macropthalmia were estimated to have migrated past the Red River trap in 2006.

In 2006 a total of 504 ammocoetes was captured by electroshocking from 18 of 62 sites sampled in the Clearwater River drainage (Figure 3) (Tables 2, 3, 4 and 5).

In 2006, a total of six Pacific lamprey ammocoetes were captured by electroshocking in Red River (Table 2). Pacific lamprey were found in three locations of Red River from the mouth upstream to rkm 7.5 in 2006, compared to nine locations in 2005. As in 2000-2005, no Pacific lamprey ammocoetes or macropthalmia were captured in Red River sample sites above rkm 7.5 in 2006. The largest Pacific lamprey ammocoete captured through electroshocking in the Red River watershed in 2006 was 175 mm TL and the smallest measured 165 mm TL (Figures 7 and 8). For electroshocked Pacific lamprey ammocoetes captured in Red River the difference between mean total lengths in 2000 (139.5 mm) and 2006 (170.4 mm) was statistically significant ($t=-12.495$, $P<0.000$). Site-specific densities of ammocoetes in Red River in 2006

ranged from a high of 54 fish/100 m^2 (rkm 3.43) to a low of 0 fish/100 m^2 (rkm 0.6, 0.7, 0.99, 5.0 and 6.0) (Table 2).

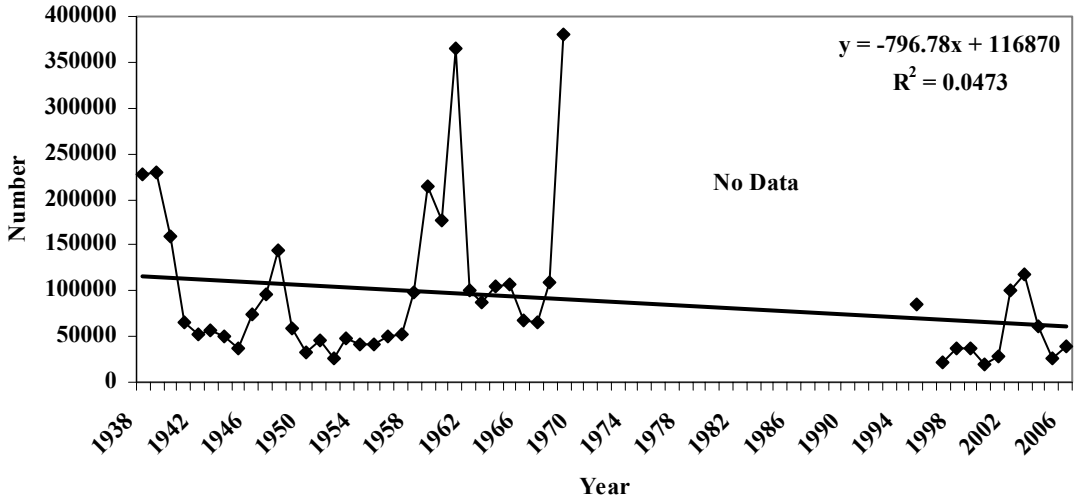

Figure 4. Pacific lamprey adult upstream passage 1938-2006, Bonneville Dam, OR (USACE 2006).

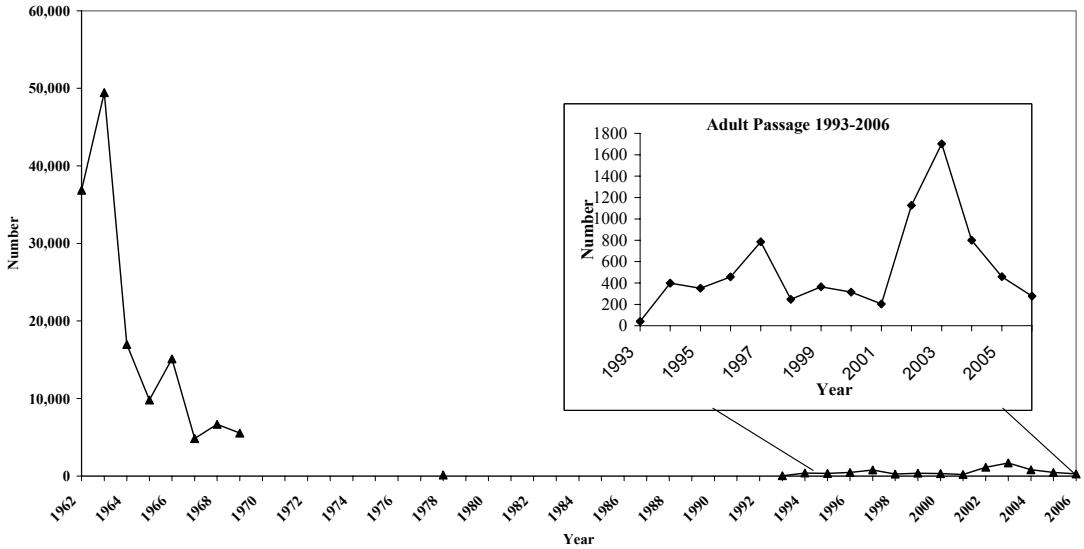

Figure 5. Pacific lamprey adult upstream passage 1962-2006, Ice Harbor Dam, WA (USACE 2006).

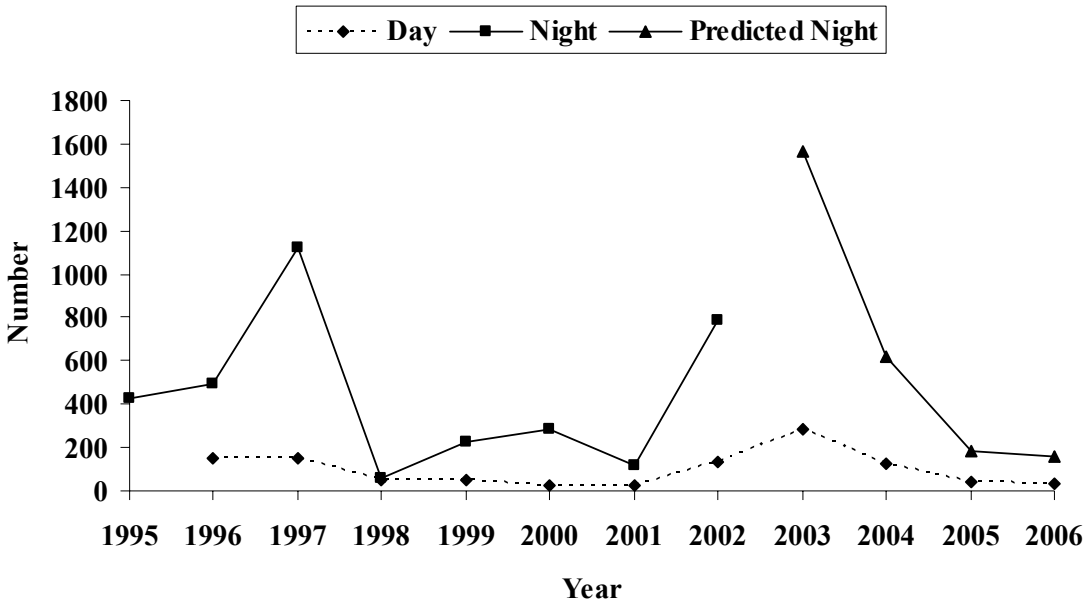

Figure 6. Pacific lamprey adult upstream passage (day and night) 1995-2006, Lower Granite Dam, WA (USACE 1995-2006). Regression analysis was used to predict night counts for 2003-2006 (when night counts were not collected) using the equation, night count = 5.7(day count) – 44.5 (R^2 = 0.71).

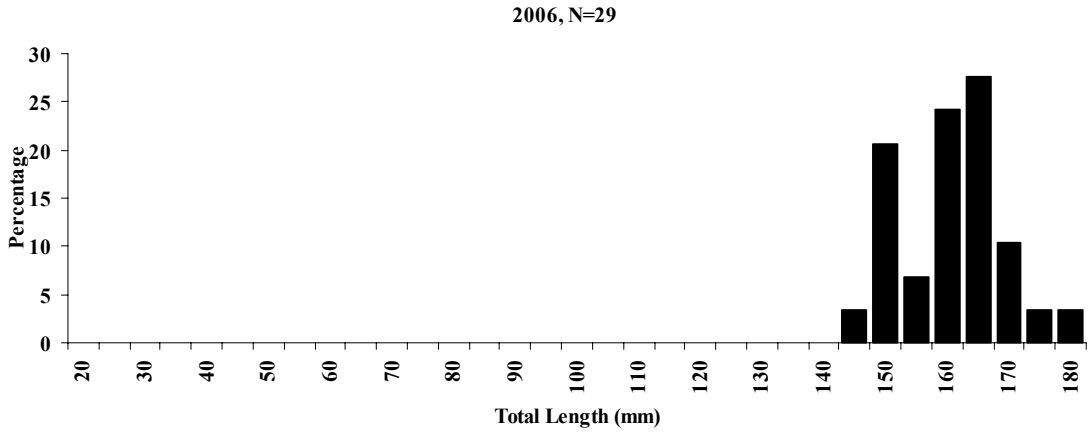

Figure 7. Length frequencies of Pacific lamprey ammocoetes captured at Red River rotary screen trap at rkm 5.0, 2006.

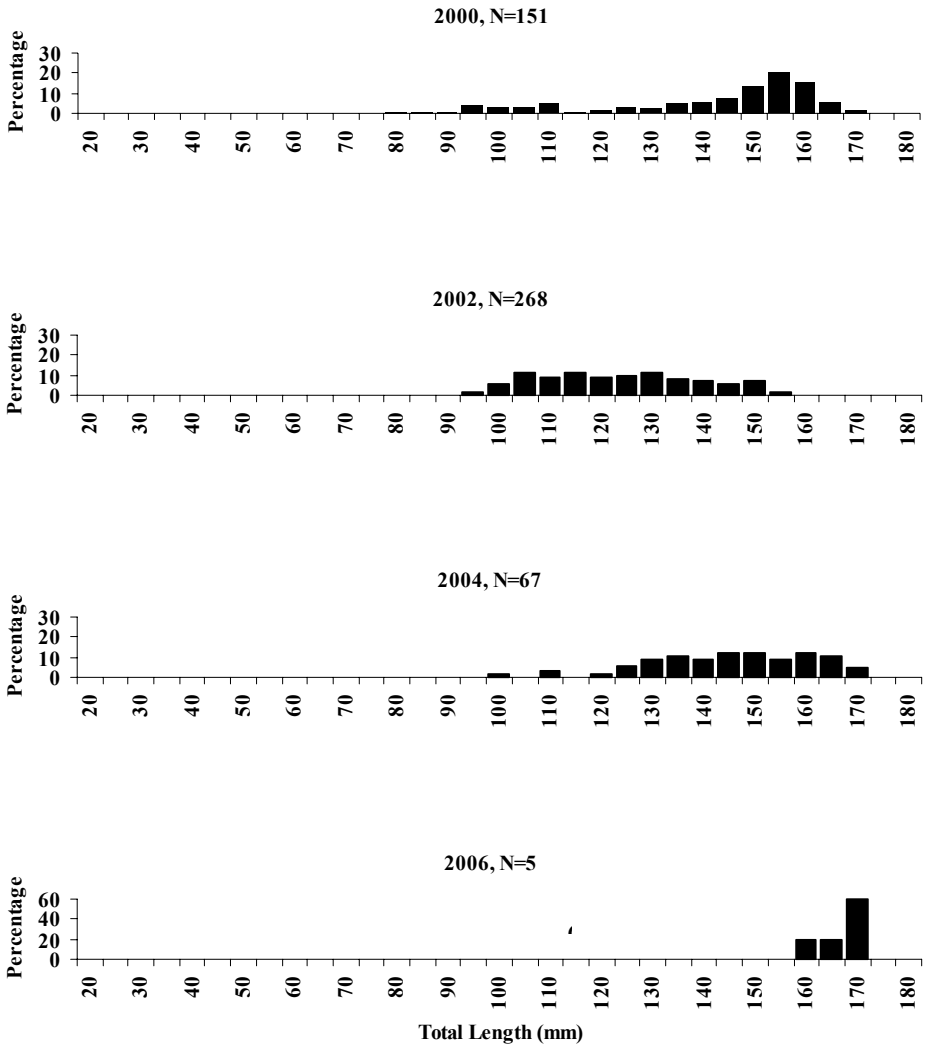

Figure 8. Length frequencies of Pacific lamprey ammocoetes collected by electroshocking in Red River, 2000, 2002, 2004, and 2006.

Table 2. Abundance trend surveys of Pacific lamprey ammocoetes in Red River, ID, 2001, 2003-2006.

Year	RKM	Lamprey Captured	Total Area Fished (m^2)	Total Time Fished (Min)	Fish /100m^2
2001	0.00	33	10.0	18.4	330
	5.00	54	15.2	21.6	355
	6.00	5	1.3	1.4	385
	7.00	8	6.0	7.3	133
2003	5.00	10	5.0	-	200
	6.00	24	5.0	5.5	480
	7.00	1	1.0	2.0	100
	7.08	16	5.0	8.7	320
2004	0.50	5	5.0	2.9	100
	0.99	3	3.6	2.2	83
	3.40	1	5.0	5.7	20
	5.00	16	10.0	3.7	160
	5.85	16	5.0	3.2	320
	6.40	30	5.0	4.0	600
	7.00	8	5.0	3.4	160
2005	0.60	3	5.0	2.7	60
	0.60	3	5.0	3.4	60
	0.70	0	9.0	5.4	0
	0.99	3	8.8	4.1	34
	3.43	2	7.5	4.0	27
	3.43	2	5.0	2.5*	40
	5.00	8	7.5	3.4	107
	6.00	7	5.0	3.7	140
	6.40	6	5.0	3.1	120
	7.00	4	5.0	3.1	80
2006	0.60	0	6.8	4.9	0
	0.80	0	4.0	2.8	0
	0.99	0	5.0	2.7	0
	3.43	4	7.4	6.5	54
	5.00	0	7.4	7.0	0
	6.00	0	4.1	3.6	0
	6.40	1	3.6	4.7	28
	7.00	1	5.3	5.2	19

* Estimate.

Table 3. Abundance trend surveys of Pacific lamprey ammocoetes in S. F. Clearwater River, ID, 2001-2006.

Year	RKM	Lamprey Captured	Total Area Fished (m^2)	Total Time Fished (Min)	Fish /100m^2
2001	1.1	13	10.0	15.0	130
	14.5	31	5.0	18.0	620
	27.4	35	10.0	20.0	350
	34.2	15	5.0	11.5	300
	38.5	1	2.0	8.3	50
	40.7	5	10.0	18.0	50
	53.1	32	6.0	10.0*	533
	56.5	20	2.2	3.9	909
	59.4	39	10.0	17.0	390
	66.2	25	10.0	20.0	250
	83.0	7	10.0	13.0	70
	86.5	4	10.0	10.6	40
	94.8	26	6.0	18.7	433
	100.4	2	10.0	13.2	20
2002	40.7	50	10.0	13.0	500
	59.4	24	10.0	12.0	240
2003	40.7	51	10.0	9.3	510
	59.4	12	5.0	4.3	240
2004	40.7	26	5.0	2.5	520
	56.5	13	4.0	2.5	325
	59.4	5	5.0	2.5	100
	86.5	1	5.0	2.5	20
	94.8	14	5.0	4.4	280
2005	40.7	87	6.0	4.9	1450
	56.5	40	3.0	4.9	1333
	59.4	20	5.0	2.8	400
	86.5	1	5.0	3.2	20
	94.8	20	12.5	7.1	160
2006	40.7	85	2.6	2.6	3269
	56.5	11	3.0	3.0	367
	59.4	8	5.0	5.0	160
	86.5	0	5.0	5.0	0
	94.8	31	5.3	5.3	585

* Estimate.

Table 4. Abundance trend surveys of Pacific lamprey ammocoetes in the Lochsa River, ID, 2002-2006.

Year	RKM	Lamprey Captured	Total Area Fished (m^2)	Total Time Fished (Min)	Fish /100m^2
2002	22.1	38	2.0	11.0	1900
	58.3	12	5.0	12.5.	240
	75.3	4	5.0	9.0	80
2003	22.1	10	2.0	3.0	500
	58.3	12	5.0	5.5	240
2004	22.1	12	10	1.8	1200
	39.4	34	5.0	4.7	680
	58.3	5	5.0	3.0	100
2005	22.1	39	1.0	3.6	3900
	39.4	67	2.4	3.1	2792
	58.3	19	6.0	4.4	317
	75.3	28	5.0	5.7	560
2006	22.1	83	1.0	0.3	8300
	39.4	64	2.0	16.1	3200
	58.3	18	4.0	4.7	450
	75.3	6	5.0	4.8	120

Table 5. Abundance trend surveys of Pacific lamprey ammocoetes in the Selway River, ID, 2002-2006.

Year	RKM	Lamprey Captured	Total Area Fished (m^2)	Total Time Fished (Min)	Fish /100m^2
2002	7.6	45	5.0	13.0	900
	29.1.	16	5.0	`16.0	320
2003	7.6	26	5.0	5.6	520
	29.1	9	5.0	-	180
	31.6	6	5.0	3.9	120
2004	7.6	30	5.0	3.9	600
	23.0	21	5.0	3.1	420
	29.1	5	5.0	4.1	100
	31.6	11	5.0	4.3	220
2005	7.6	32	1.0	3.0	3200
	17.1	29	2.5	3.6	1160
	25.9	35	2.5	4.7	1400
	29.1	33	5.0	5.6	660
	31.6	33	3.0	4.6	1100
2006	7.6	6	1.0	1.9	600
	17.1	28	2.0	3.6	1400
	25.2	43	3.0	4.7	1433
	29.1	42	6.0	11.6	700
	31.4	0	2.0	1.9	0
	31.6	0	3.0	2.8	0
	32.0	44	10.5	13.0	419

One-hundred thirty-six Pacific lamprey ammocoetes were captured from 4 of 5 sites sampled in the S.F. Clearwater River in 2006 (Table 3). The largest ammocoete measured 144 mm TL while the smallest measured 15 mm TL (Figures 9 and 10). One macropthalmia measuring 164 mm TL was collected. Site-specific densities of ammocoetes ranged from a high of 3,269 fish/100m^2 (rkm 40.7) to a low of 0 fish/100m^2 (rkm 86.5) (Table 3).

One-hundred sixty-three ammocoetes were captured from 5 of 7 sites sampled in the Selway River in 2006 (Table 5). The largest ammocoete measured 130 mm TL while the smallest measured 25 mm TL (Figures 9 and 11). Site-specific densities of ammocoetes in Selway River ranged from a high of 1,433 fish/100m^2 (rkm 25.2) to a low of 0 fish/100m^2 (rkm 31.4 and 31.6).

One-hundred seventy-one ammocoetes were captured from 4 of 5 sites sampled in the Lochsa River in 2006 (Table 4). The largest ammocoete measured 123 mm TL while the smallest measured 37 mm TL (Figures 9 and 12). Site-specific densities of ammocoetes in Lochsa River ranged from a high of 8,300 fish/100m^2 (rkm 22.1) to a low of 120 fish/100m^2 (rkm 75.3) in 2006.

The largest ammocoete (175 mm TL) captured in the Clearwater River drainage in 2006 was captured in Red River and the smallest (15 mm TL) was captured in S. F. Clearwater River (Figure 9).

NPTF rotary screen trap operations at rkm 21.0 Lolo Creek in the Lolo Creek watershed captured a total of 496 Pacific lamprey ammocoetes and macropthalmia during the period 1994-2003 (Figure 13), however, trapping efforts have failed to capture any ammocoetes or macropthalmia since 2003.

Eight ammocoetes were captured in the Newsome Creek rotary screen trap (rkm 0.10) 1998-2003 with one ammocoete captured in 2002 and none since.

In 2006 a total of 367 ammocoetes was captured from 19 of 74 sites sampled in the Salmon River drainage (including tributaries) from the headwaters upstream of Pole Creek (rkm 647.0) downstream to Hammer Creek boat launch at rkm 52.7 (Figure 14) (Tables 6 and 7).

A total of 216 ammocoetes was captured from 13 of 33 sites sampled in the mainstem Salmon River in 2006 (Tables 6 and 7). The largest ammocoete measured 145 mm TL while the smallest measured 22 mm TL (Figures 15 and 16). Site-specific densities of ammocoetes in mainstem Salmon River ranged from a high of 1,769 fish/100m^2 (rkm 342.8) to a low of 0 fish/100m^2 (rkm 84.8) (Tables 6 and 7). Densities in interim years have varied widely from year to year and location to location (Tables 6 and 7).

In 2006 we sampled six locations from 0.9 km below Loon Creek at rkm 72.3 downstream to Mormon Ranch (rkm 48.3) in the M. F. Salmon River and captured a total of 151 ammocoetes from 6 of 7 sites sampled (Table 7). We did not sample any M. F. Salmon River tributaries in 2006. The largest ammocoete measured 121 mm TL while the smallest measured 50 mm TL (Figures 15 and 17). Site-specific densities of ammocoetes in M.F. Salmon River ranged from a high of 617 fish/100m^2 (rkm 72.4) to a low of 200 fish/100m^2 (rkm 56.7) (Table 7).

Data from each year of the study (2000-2006) was combined for length-weight regression analysis and only fish 60 mm TL or greater were included in the development of the equations. Our calculations yielded the following length-weight regression equations for the

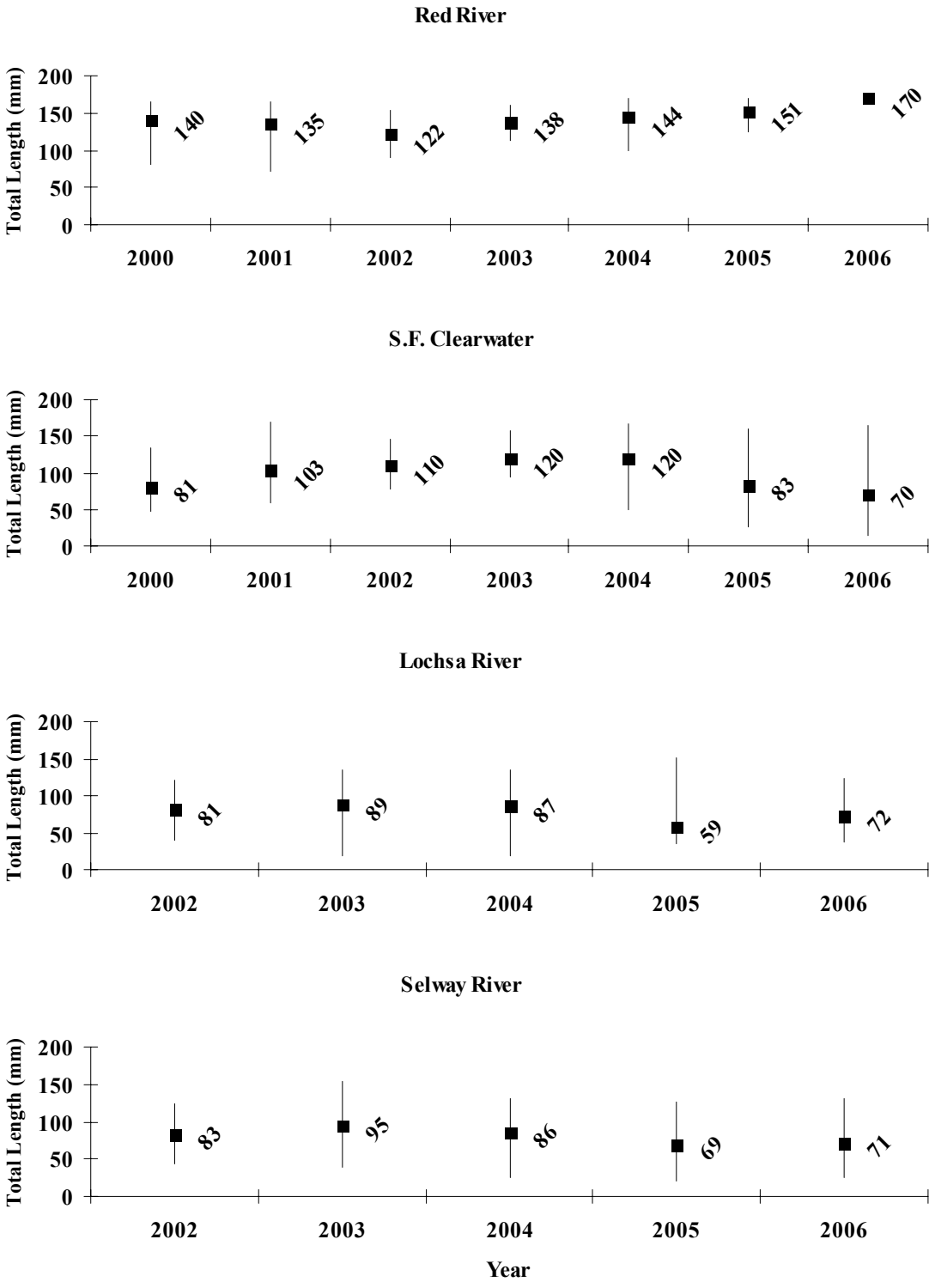

Figure 9. Minimum, maximum, and mean total length (mm) of Pacific lamprey ammocoetes collected by electroshocking in the Clearwater River drainage, ID, 2000-2006.

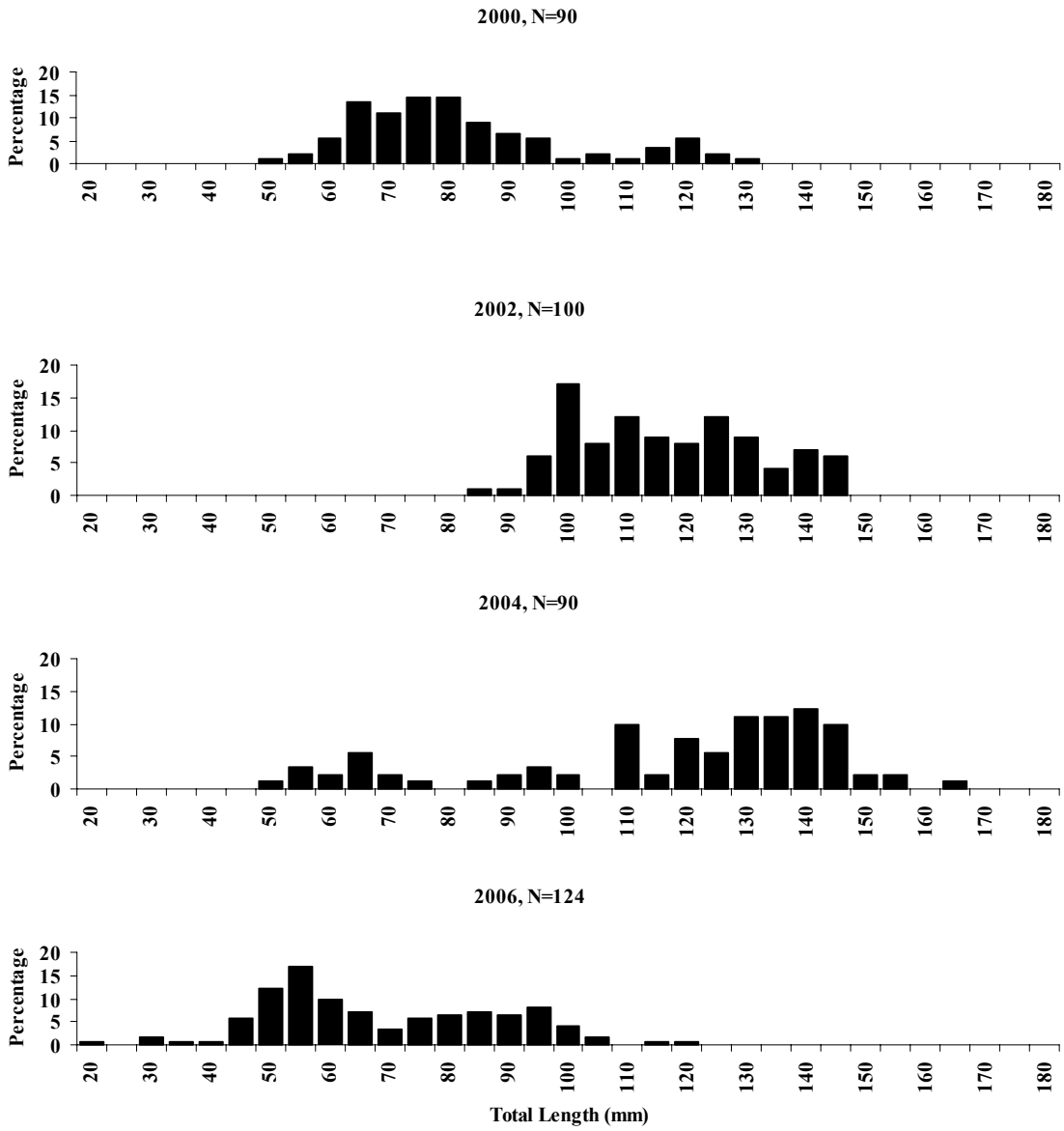

Figure 10. Length frequencies of Pacific lamprey ammocoetes collected by electroshocking in S.F. Clearwater River, 2000, 2002, 2004 and 2006.

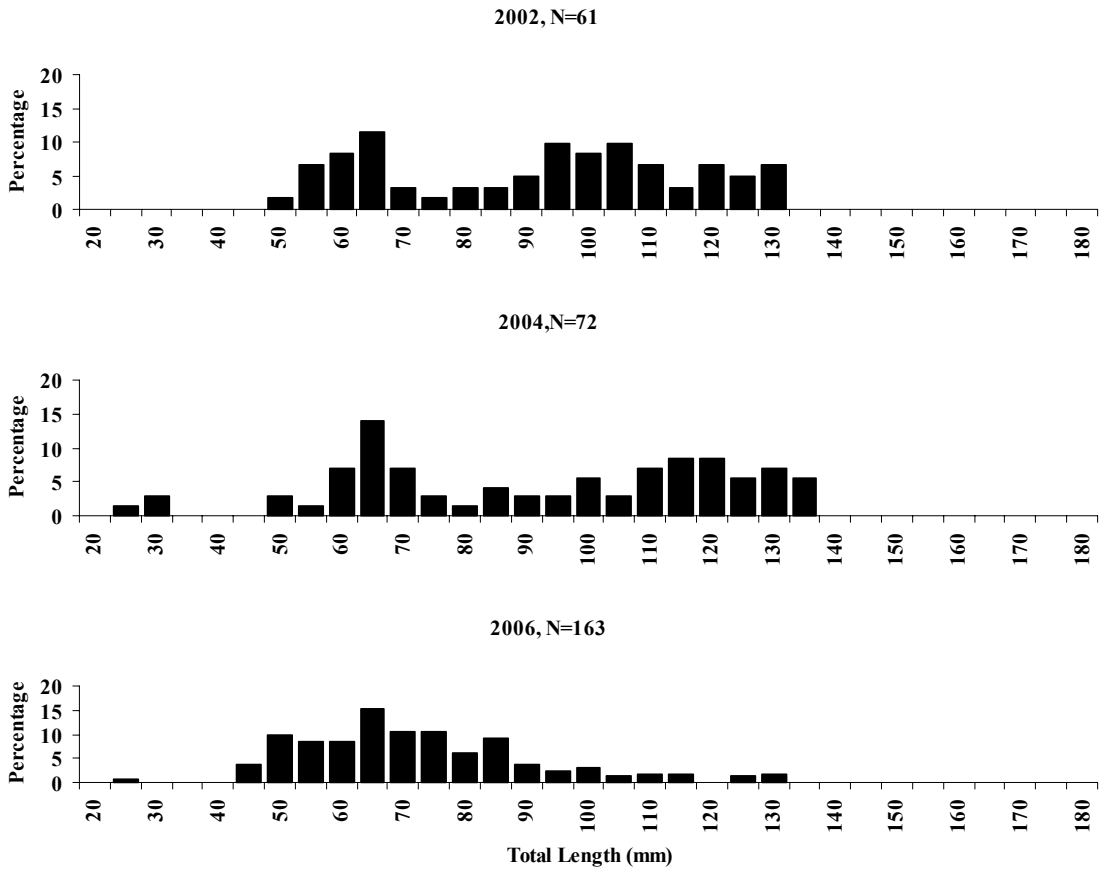

Figure 11. Length frequencies of Pacific lamprey ammocoetes collected by electroshocking in the Selway River, 2002, 2004, and 2006.

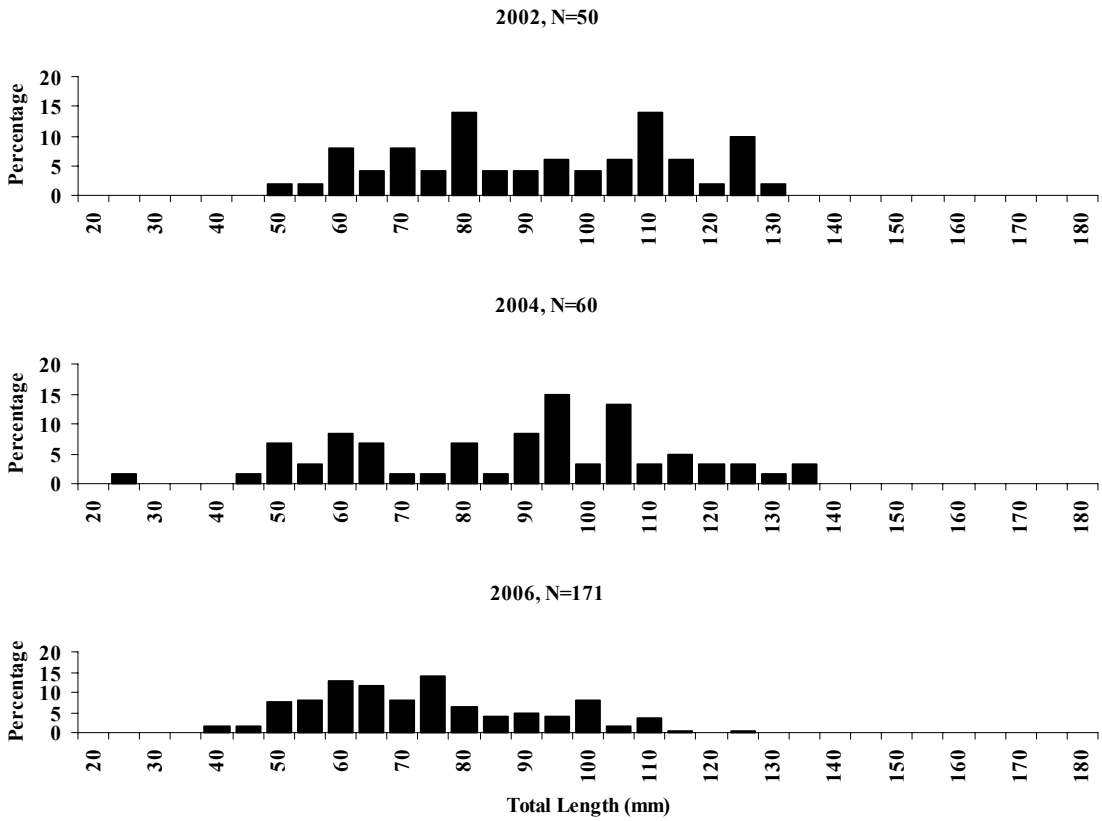

Figure 12. Length frequencies of Pacific lamprey ammocoetes collected by electroshocking in the Lochsa River, 2002, 2004, and 2006.

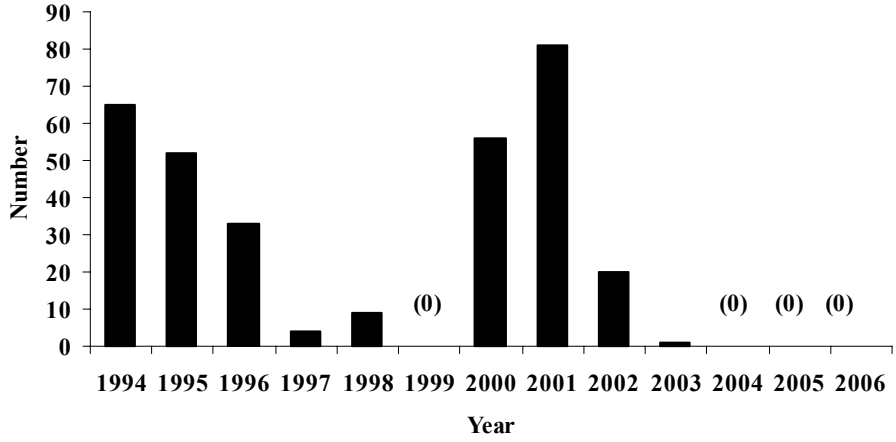

Figure 13. Pacific lamprey captured (N=496) in NPTF rotary screen trap Lolo Creek (rkm 21.0) 1994-2006, Clearwater River watershed, ID (Sprague and Johnson 2006).

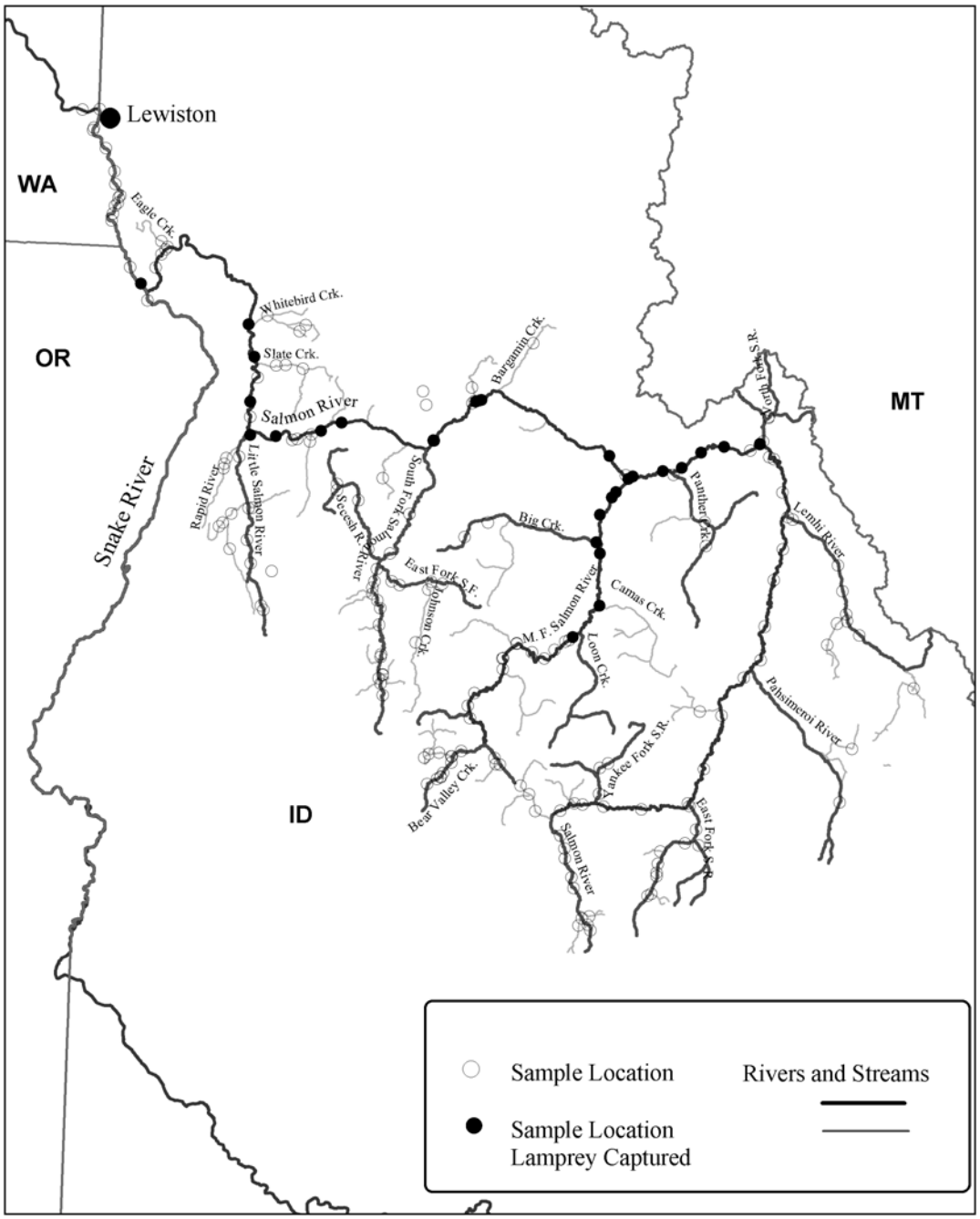

Figure 14. Location of Pacific lamprey investigations and distribution in the Salmon River drainage, ID, 2003-2006.

Table 6. Abundance trend surveys of Pacific lamprey ammocoetes in the mainstem Salmon River above the S.F. Salmon River and between the S.F. Salmon River and the Little Salmon River, ID, 2003-2006.

Year	RKM	Lamprey Captured	Total Area Fished (m^2)	Total Time Fished (Min)	Fish /100m^2
Above S.F. Salmon River					
2003	221.1	6	5.0	5.2	120
2004	221.1	11	5.0	4.1	220
	244.2	0	5.0	2.5	0
	245.2	0	5.0	2.4	0
	247.6	20	10.0	4.3	200
2005	221.1	35	10.0	5.8	350
	245.4	20	5.0	4.5	400
	247.6	19	6.0	3.2	317
	307.0	42	6.3	4.2	667
	321.0	29	5.0	4.8	580
	334.2	25	5.0	4.6	500
	342.8	44	3.8	6.1	1158
	351.9	27	2.0	3.2	1350
	364.4	41	2.0	3.5	2050
	380.1	5	5.0	3.2	100
	380.1	1	5.0	2.1	20
2006	217.6	16	3.0	5.6	533
	245.4	8	2.0	3.5	400
	307.0	16	8.0	6.6	200
	334.2	56	4.	7.6	1400
	342.8	23	1.3	4.8	1769
	351.9	17	3.0	5.8	567
	364.4	13	2.0	3.9	650
	380.1	4	5.0	4.8	80
Between S.F. Salmon River and Little Salmon River					
2004	152.6	5	5.0	2.4	100
	161.1	0	5.0	2.8	0
	172.4	29	5.0	3.6	580
2005	152.6	6	5.0	2.9	120
	163.1	0	5.0	3.2	0
	172.4	7	5.0	3.1	140
2006	163.3	8	4.0	5.8	500
	172.4	37	6.3	7.9	587

Table 7. Abundance trend surveys of Pacific lamprey ammocoetes in the mainstem Salmon River below the Little Salmon River, 2003-2006, and in the M.F. Salmon River, 2005-2006, ID.

Year	RKM	Lamprey Captured	Total Area Fished (m^2)	Total Time Fished (Min)	Fish /100m^2
Below Little Salmon River					
2003	84.8	1	5.0	3.5	20
	103.5	0	5.0	2.9	0
	125.2	1	5.0	4.8	20
2004	84.8	0	5.0	2.8	0
	103.5	0	5.0	2.6	0
	125.2	0	5.0	3.0	0
2005	84.8	0	4.0	3.8	0
	103.5	0	4.0	2.4	0
	125.2	0	10.0	3.2	0
2006	84.8	0	5.0	3.1	0
	124.4	2	8.0	5.4	25
M.F. Salmon River					
2005	10.4	19	22.8	6.0	83
	18.4	66	17.4	8.0	379
	34.0	34	58.4	10.0	58
	56.6	35	11.8	5.0	297
	56.6	30	32.9	6.0	91
	76.1	39	23.5	8.0	166
	78.7	22	74.6	12.0	478
2006	48.3	18	5.0	5.1	360
	52.8	20	7.0	8.8	286
	56.7	8	4.0	4.3	200
	62.4	6	1.0	4.4	600
	72.4	37	6.0	9.9	617

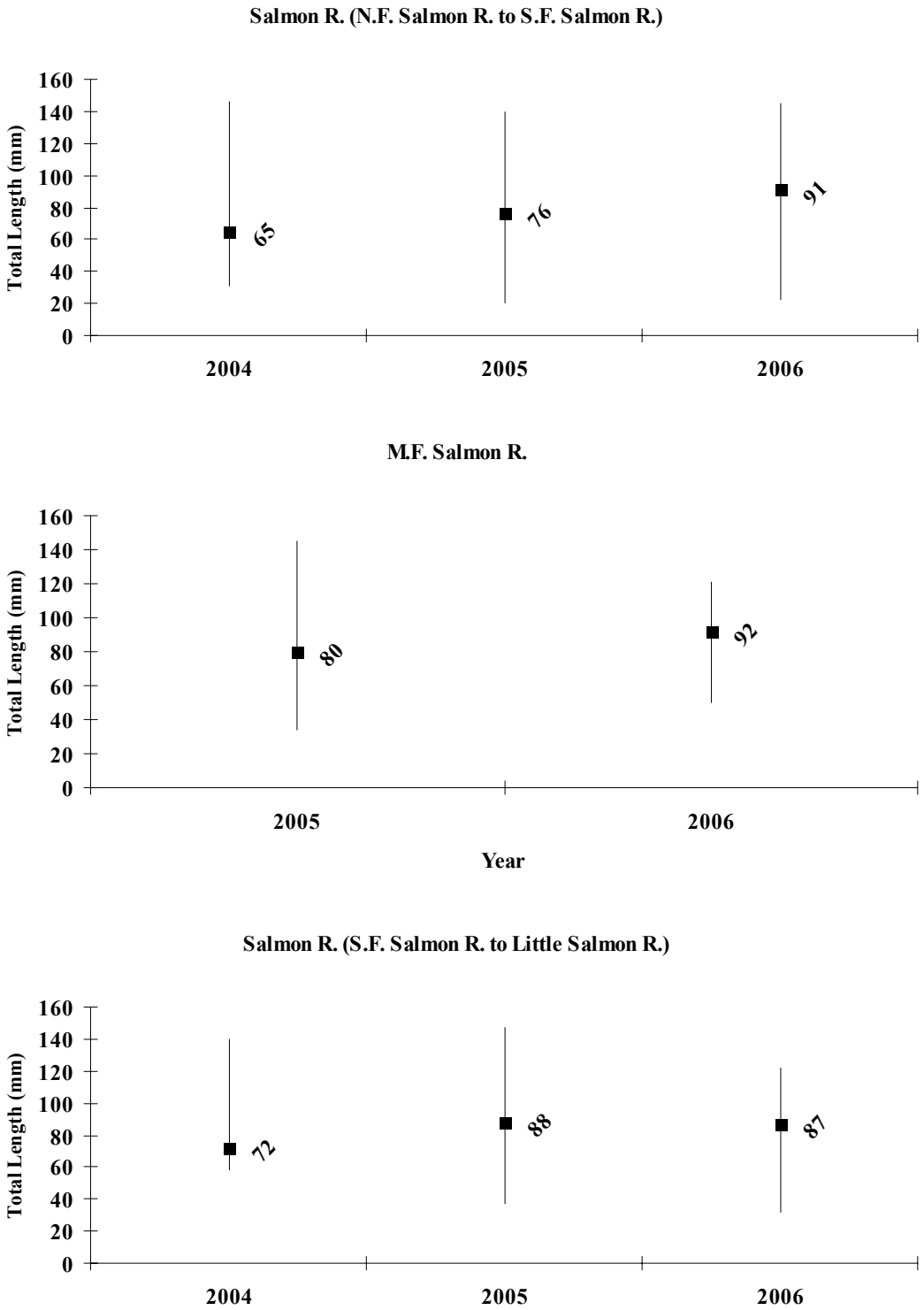

Figure 15. Minimum, maximum, and mean total length (mm) of Pacific lamprey ammocoetes collected by electroshocking the Salmon River drainage, ID, 2004-2006.

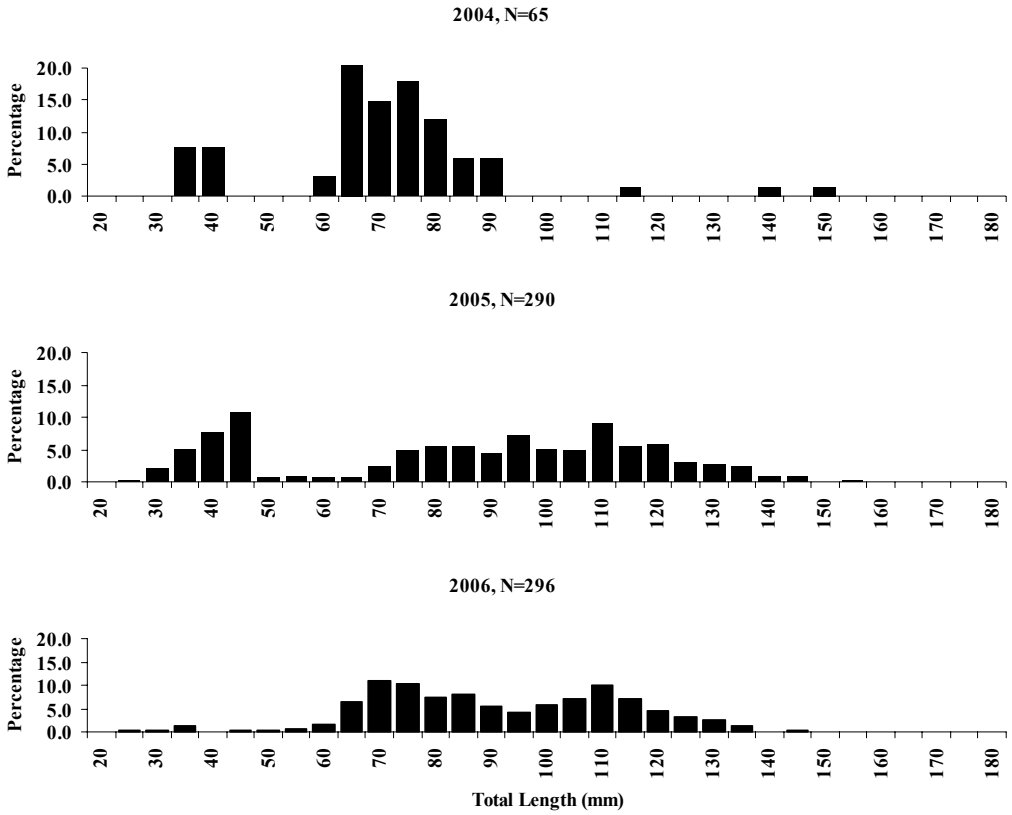

Figure 16. Length frequencies of Pacific lamprey ammocoetes captured by electroshocking in main Salmon River, 2004-2006.

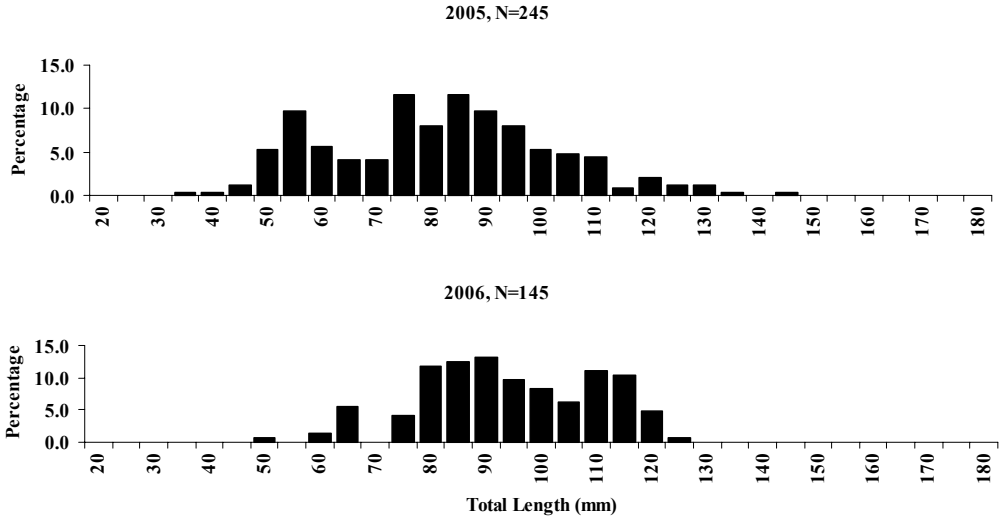

Figure 17. Length frequencies of Pacific lamprey captured by electroshocking in the M.F. Salmon River, 2005-2006.

Selway River, Lochsa River, S.F. Clearwater River, Red River, mainstem Salmon River, and M.F. Salmon River (see Table 8 for the equations). Using these equations, estimated weights at length were generated and back-transformed. We then plotted estimated weight (g) as a function of total length (mm) to describe the length-weight relationship for each population (Figure 18).

In 2006 five ammocoetes with multiple white spots located in the tissue surrounding their gills were collected from the Salmon River, near rkm 172.4, and submitted to the Idaho Fish Health Laboratory in Orofino, ID for analysis. Microscopy analysis revealed all five ammocoetes were infected with the digenetic trematode *Nanophyetus salmincola*.

Table 8. Length-weight regression equations for Pacific lamprey ammocoetes and macropthalmia collected by electroshocking in Clearwater and Salmon river drainages, ID, 2000-2006.

Population	**Sample Size**	**Equation**
Selway River	270	$\log_{10}W_t$=-5.044 + 2.630 $\log_{10}$TL
Lochsa River	238	$\log_{10}W_t$=5.149 + 2.692 $\log_{10}$TL
S.F. Clearwater River	615	$\log_{10}W_t$=5.115 + 2.673 $\log_{10}$TL
Red River	801	$\log_{10}W_t$=5.432 + 2.832 $\log_{10}$TL
Mainstem Salmon River	277	$\log_{10}W_t$=5.112 + 2.658 $\log_{10}$TL
M.F. Salmon River	66	$\log_{10}W_t$=5.350 + 2.801 $\log_{10}$TL

Total length (TL) is in millimeters and weight (W_t) is in grams.

DISCUSSION

Adult Pacific lamprey passage over lower Columbia and Snake River dams indicates a downward trend in abundance in the 1962-2006 period (Figures 4, 5, and 6). Pacific lamprey ammocoete densities observed in 2000-2006 reflect overall low population abundance and truncated distribution compared to historical distribution in the Clearwater River drainage. The number of spawning adults in the Clearwater River and Salmon river drainages is suspected to have averaged fewer than 200 Pacific lamprey annually, 1995-2006, in the individual drainages. The Clearwater River drainage estimated spawning adult escapement of 200 adults is based on Lower Granite Dam passage of an average of less than 600 adults in the 1998-2006 period and assumption of even distribution of Pacific lamprey adults into the Grande Ronde, Imnaha, Salmon, and Clearwater rivers with fewer than one-third of Clearwater River drainage spawners returning to the S.F. Clearwater River.

Pacific lamprey are primarily nocturnal (Moser et al. 2002) and often migrate upstream at night. Nighttime counts were completed at Lower Granite Dam 1995-2002 (Figure 6) and are considered critically strategic in conjunction with daytime counts to determine relative abundance of Pacific lamprey adult escapement into the Snake River subbasin upstream of the project. Because night counts were not conducted at Lower Granite Dam from 2003 to 2006, we used regression analysis of night versus day counts to predict night counts for this time period.

Sampling in 2000-2006 in the S.F. Clearwater River watershed firmly indicates distribution of Pacific lamprey in the watershed is restricted to the mainstem S.F. Clearwater River and the lower Red River. However, the number of ammocoetes captured in lower Red River has declined every year of the study while the mean length of ammocoetes has steadily increased suggesting a lack of recruitment. In 2006, Pacific lamprey ammocoetes captured in Red River ranged from 165 mm TL to 175 mm TL. Based on this length range, the estimated age composition for the Red River population appears to be dominated by individuals that will begin their migration to the ocean sometime in late 2006 or 2007. Either way, without a substantial increase in recruitment in the next year or two, it is likely the lower Red River population will become extirpated. Suitable habitat remains in the upper Red River, American River, Crooked River, but Pacific lamprey ammocoetes and macropthalmia were not found. Despite work in the Newsome Creek watershed in 2001 no Pacific lamprey were captured, and NPTF rotary screen trapping efforts failed to capture lamprey 2003-2006 indicating remnants of a Pacific lamprey population in the stream have likely reached the final stage of decline.

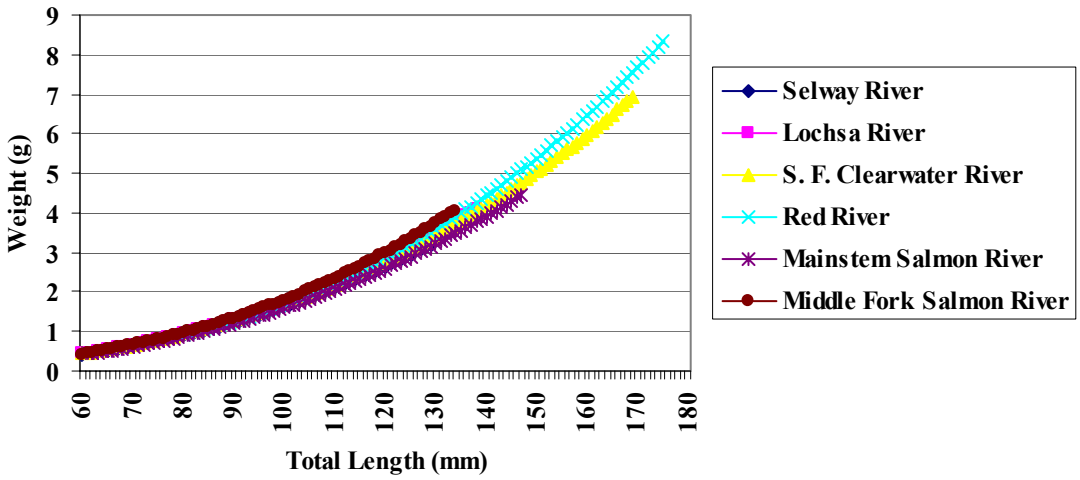

Figure 18. Length-weight relationships for Pacific lamprey ammocoetes captured by electroshocking (all available years data combined).

While smaller length groups of Pacific lamprey have consistently been captured in the Selway and Lochsa rivers, the distributions in these watersheds are limited to lower mainstem reaches. No ammocoetes or macropthalmia were found in any tributary of either watershed.

A total of 840 (154, 186, 274, 65, 88, 67 and 6) Pacific lamprey ammocoetes was captured by electroshocking in Red River in 2000-2006. During this time period, no Pacific lamprey ammocoetes or macropthalmia was captured in any tributary or the mainstem Red River above rkm 7.5. From 2000 to 2006, the smallest (by length) Pacific lamprey captured in Red River increased annually, likely reflecting little or no recruitment in the watershed for the last 3-6 years. Length frequency depiction of Red River ammocoetes (Figure 8) strongly supports that recruitment had already become limited in Red River prior to the start of the study in 2000.

The minimum length of ammocoetes in the S. F. Clearwater River increased annually from 2000 (47 mm TL) to 2003 (95 mm TL) also suggesting a lack of recruitment during this time period. However, in 2004 a 49 mm TL ammocoete was captured indicating that recruitment, at least to a small degree, did occur in 2002. In 2005 large gaps were visible in the length frequency distribution, however, some representation of younger age classes were present (Cochnauer et al. 2005). In 2006 mean TL of captured ammocoetes was the lowest of any year during the study (Figure 9) and the length frequency distribution portrays a population dominated by smaller length groups. We believe the increase in the minimum length ammocoete captured over the 2000-2003 study period, reflected a lack of recruitment in the S.F. Clearwater River watershed; whereas the decrease in the minimum length ammocoete captured over the 2004-2006 study period reflects successful recruitment in the past 3 years (Figure 9). Analysis of variance of the S.F. Clearwater River ammocoete average lengths 2000-2004 augmented the minimum length information indicating the average length has increased in the period ($P<0.0001$, $\alpha=0.05$). In 2006 recent recruitment was detected at 2 of the 5 locations sampled (0.8 km below Castle Creek at rkm 40.7 and 0.03 km above Johns Creek at rkm 56.6).

At collection sites throughout the Clearwater River drainage densities vary widely from site to site, river to river, and year to year (Table 2, 3, 4 and 5). Due to factors such as variability in flow regimes, annual downstream movement patterns, distributional shifts, and year class recruitment, abundance trends are difficult to document at this point.

Work in 2000-2002 identifying the habitat preference of Pacific lamprey indicated a preference for pool habitat in locations with associated instream structure. Work since 2002 has continued to support this as more Pacific lamprey ammocoetes have been captured in the Clearwater River drainage through sampling of lateral scour pool habitat than any other single habitat type (Cochnauer et al. 2005). Individuals throughout the Clearwater River drainage were mostly found inhabiting sand and silt substrates in calm water sites, low velocity pockets behind boulders, and or adjacent to overhanging riparian canopy cover in low velocity pockets behind boulders (Cochnauer et al. 2005).

Scott and Crossman (1998) and Simpson and Wallace (1982) state that Pacific lamprey were distributed historically in streams similarly occupied by salmon and steelhead trout throughout the Columbia River basin. Gilbert and Evermann (1894), Keating (1958), Hammond (1979b), and many unpublished data files firmly support this assessment. The persistence of Pacific lamprey (represented by multiple-age classes) in the Clearwater River drainage appears to be linked with high water quality in streams such as the Selway and Lochsa rivers (Dechert 2003, Gerhardt 1993). Streams with impaired water quality which supported Pacific lamprey populations historically either do not support present populations as in Potlatch River or

Lawyers Creek, or support declining populations such as found in Lolo Creek and the S.F. Clearwater River watershed. Pacific lamprey populations persist in the Selway and Lochsa river watersheds where the instream rearing habitat is largely considered good to excellent, however, excellent habitat quality in spawning and rearing streams is considered incapable of adequately compensating for the limited number of returning adult Pacific lamprey passing Lower Granite Dam.

In the 1970's, Hammond (1979a) captured Pacific lamprey ammocoetes in the mainstem and E.F. of the Potlatch River upstream of Kendrick, ID. In 2002 we sampled the mainstem Potlatch River, Bear Creek, and the E.F. Potlatch River and did not find lamprey. We resampled sites in the mainstem Potlatch River and E. F. Potlatch River in 2005-2006 and again failed to capture any lamprey. Pacific lamprey have been extirpated in the Potlatch River watershed.

It is unknown if the populations of Pacific lamprey in the Clearwater River drainage are in the initial stages of approaching a critical unrecoverable threshold, however, of the 383 sites sampled within the potential current range throughout the Clearwater River drainage in 2000-2006, only 127 (33.2%) produced Pacific lamprey (Table 10).

Impoundment construction in the Snake River subbasin since 1900, culminating with the Idaho Power Company construction of the Hells Canyon hydroelectric complex (Brownlee Dam, Oxbow Dam, and Hells Canyon Dam) 1958-1967 and Dworshak Dam in 1972, reduced anadromous accessible habitat in the Snake River subbasin by 59% (Table 9). Throughout the Clearwater River drainage, the 2006 distribution is estimated 33% of the drainage area occupied in 1960, a reduction of 66%. However, analysis of 3rd and 2nd order streams previously excluded in assessment of historical distribution in the drainage suggests the decline potentially approaches 75% (Cochnauer et al. 2005). Information obtained from 2000-2006 reflects population minimal numbers and distribution ranges restricted to remaining preferred habitat in the entire Clearwater drainage.

Sampling in the Salmon River drainage 2004-2006 suggests Pacific lamprey are no longer present in any tributary to the Salmon River except for the mainstem M. F. Salmon River. Hammond (1979b) captured Pacific lamprey ammocoetes in the Stolle Meadows reach of the S.F. Salmon River in 1979, while the U.S. Forest Service Payette National Forest fisheries personnel documented Pacific lamprey as recently as the mid or late 1980's in the drainage (D. Burn, Payette National Forest, personal communication). It is likely Pacific lamprey are no longer present in most 3rd, 4th, and 5th order streams in the Salmon River drainage upstream of the M.F. Salmon River. In 2005-2006 sampling efforts documented Pacific lamprey in the mainstem Salmon River upstream to the N.F. Salmon River (rkm 381.4) and in the M.F. Salmon River upstream to rkm 78.7. In 2005 and 2006 we failed to capture any ammocoetes while sampling the Lemhi River, Pahsimeroi River, E.F. Salmon River, Yankee Fork of the Salmon River and upper mainstem Salmon River suggesting these systems no longer support Pacific lamprey populations. It appears Pacific lamprey no longer exist above the confluence of the N. F. Salmon River and the Salmon River.

Weight-length relationships of Pacific lamprey ammocoetes collected by electroshocking in the Selway River, Lochsa River, S.F. Clearwater River, Red River, mainstem Salmon River and M.F. Salmon River show weight at length differences between these rivers, but the

Table 9. Pacific lamprey accessible drainage area 1850 and 2006, and occupied stream km's 1960 and 2006 for 4'th and greater order and selected 3'rd order streams in the Snake River subbasin, ID, OR, WA. Historical distribution based on Gilbert and Evermann (1894), Keating (1958), and Scott and Crossman (1998).

Stream Site	Length (km)	Drainage Area (ha)	Access Area Circa 1850 (ha)	Access Area 2005 (ha)	Access Area % Change	Stream Occupied 1960 est (km)	Stream Occupied 2005 (km)	Stream Occupied % Change 1960-2005
Snake River								
Mainstem						989.8**	397.6***	-59.8
Palouse River	251.5	850,518	~1500	~1500	0.0	11.3	11.3	0.0
S.R. Hells Cnyn Dam	397.7	18,989,637	na	Na	na	na	na	-
S,R. Shoshone Falls	989.9	4,559,586	na	Na	na	na	na	-
Totals*		**28,238,342**	**22,034,901**	**7,767,562**	**-64.7**	**1001.1**	**408.9**	**-59.2**
Clearwater River								
Mainstem	157.1	563,990	563,990	563,990	0.0	212.1	157.1	-25.9
Potlatch River	89.4	139,896	139,896	139,896	0.0	109.4	0.0	-100.0
N.F. Clearwater River	213.2	632,124	632,124	~50	-99.9	333.2	2.0	-99.4
S.F. Clearwater River	100.6	297,927	297,927	297,927	0.0	170.6	108.1	-36.6
Lolo Creek	56.4	62,953	62,953	62,953	0.0	71.4	0.0	-100.0
Selway River	147.3	494,819	494,819	494,819	0.0	170.0	147.3	-13.4
Lochsa River	112.9	305,699	305,699	305,699	0.0	159.9	77.0	-51.8
Totals*		**2,497,408**	**2,497,408**	**1,865,334**	**-25.3**	**1226.6**	**491.5**	**-60.0**
Salmon River								
Mainstem	660.1	1,695,337	1,695,337	1,695,337	0.0	701.1	237.0	-66.2
Little Salmon River	56.4	149,223	149,223	149,223	0.0	71.4	0.0	-100.0
S.F. Salmon River	144.9	336,788	336,788	336,788	0.0	203.9	0.0	-100.0
M.F. Salmon River	180.0	733,161	733,161	733,161	0.0	211.0	73.3	-65.3
Lemhi River	90.5	329,016	329,016	329,016	0.0	100.5	0.0	-100.0
Pahsimeroi	78.9	218,912	218,912	218,912	0.0	88.9	0.0	-100.0
E.F. Salmon River	45.0	139,896	139,896	139,896	0.0	50.0	0.0	-100.0
Yankee Fork		50,518	50,518	50,518	0.0	5.0	0.0	-100.0
Totals*		**3,652,850**	**3,602,332**	**3,602,332**	**0.0**	**1431.8**	**310.3**	**-78.3**

* Includes unlisted tributary stream lengths or area
** Includes only mainstem Snake River, occupied estimate circa 1910
*** Includes only mainstem Snake River
Note 1: Occupied 1960 from historical records. anecdotal information, sampling 2000-2005, and biological judgement
Note 2:- Area Circa 1850, 2005 anadromous accessible drainage area

mechanism driving the difference is unclear. Mormon (1987) found that growth of caged larval sea lampreys *Petromyzon marinus* was dependent on density, with typically greater growth occurring in cages with fewer lamprey. We believe the Pacific lamprey ammocoete populations in the Clearwater and Salmon River drainage exist at low densities and feel it is unlikely that a difference in weight for fish of a similar length is a result of density.

For the past 5 years we noticed that ammocoetes captured from the mainstem Salmon River often exhibited small white spots in the tissue surrounding their gills. Our initial thought was the white spots were some type of fungus. Subsequent testing by the U.S. Fish and Wildlife Service, ID Fish Health Laboratory in Orofino, ID revealed the white spots were actually *Nanophyetus salmincola*, a digenetic trematode. While *Nanophyetus salmincola* is found in salmonids and other associated freshwater fish (cottids, cyprinidae, lamprey) throughout the Pacific Northwest (Millemann and Knapp 1970), to our knowledge, this is the first reporting of *Nanophyetus salmincola* in association with Pacific lamprey ammocoetes in Idaho. The pathogenicity of the trematode to fish is reported to vary greatly and appears to be related to rate of accumulation, fish size, species and stock susceptibility, infection site(s), and absolute number of metacercaria (Newcomb et al. 1991, Wood and Yasutake 1956, Baldwin et al. 1967, Milleman and Knapp 1970). The high incidence of metacercarial infections of Pacific lamprey ammocoetes in the mainstem Salmon River prompts the need for future research to determine whether this parasite negatively affects ammocoetes, and if so, to what degree and how.

ACKNOWLEDGEMENTS

This study was funded primarily by Bonneville Power Administration (Project Number 2000-028-00) with additional support from the Idaho Department of Fish and Game, U.S. Forest Service, and the Bureau of Land Management.

LITERATURE CITED

Baldwin, N. L., R. E. Millemann, and S. E. Knapp. 1967. "Salmon poisoning" disease. III. Effect of experimental *Nanophyetus salmincola* infection on the fish host. J. Parasitology 53(3):556-564.

Beamish, R. J., and C. D. Levings. 1991. Abundance and Freshwater Migrations of the Anadromous Parasitic Lamprey, *Lampetra tridentata*, in a Tributary of the Fraser River, British Columbia. Canadian Journal of Fisheries and Aquatic Sciences 48:1250-1263.

Beamish, F. W., and T. E. Medland. 1988. Age Determination for Lampreys. Transactions of the American Fisheries Society 117:63-71.

Bell, R. J. 1959. Time, Size, and Estimated Numbers of Seaward Migrations of Chinook Salmon and Steelhead Trout in the Brownlee-Oxbow Section of the Middle Snake River. Idaho Department of Fish and Game. Boise, ID.

Claire, C. W. 2003. Pacific Lamprey Larvae Life History, Habitat Utilization, and Distribution in the South Fork Clearwater River Drainage, Idaho. University of Idaho M.S. Thesis. Moscow, ID.

Close, D. A., M. Fitzpatrick, H. Li, B. Parker, D. Hatch, and G. James. 1995. Status Report of The Pacific Lamprey *Lampetra tridentata* in The Columbia River Basin. U.S. Dept. of Energy. Bonneville Power Administration.

Cochnauer, T., C. Claire, and S. Putnam. 2005. Evaluate Status of Pacific Lamprey in the Clearwater River and Salmon River drainages, Idaho. Prepared for Bonneville Power Administration. Project No. 2000-028-00. Idaho Department of Fish and Game. Boise, ID.

Dechert, T. 2003. 303D Listed Streams. Unpublished Field Data. Idaho Department of Environmental Quality. Lewiston, ID

Galbreath, J. 1979. Columbia River Colossus, the White Sturgeon. Oregon Wildlife March 1979.

Gerhardt, N. 1993. Third Annual Nonpoint Source Water Quality Monitoring Results Workshop. Idaho Department of Environmental Quality. Boise, ID.

Gilbert, C. and B. Everman. 1894. A Report on Investigations in the Columbia River Basin, With Descriptions of Four New Species of Fishes. Bulletin of the U.S. Fish Commission. In Report of the Commissioner of Fish and Fisheries on Investigations in the Columbia River Basin in Regard to the Salmonid Fisheries. Senate Miscellaneous Documents. Washington, D.C. No. 200, Serial No. 3174:19-57.

Hammond, R. J. 1979a. Larval Biology of the Pacific Lamprey, *Entosphenus tridentata* (*Gairdner*), of the Potlatch River, Idaho. University of Idaho M. S. Thesis. Moscow, ID.

LITERATURE CITED, Continued

Hammond, R. J. 1979b. Pacific Lamprey Research in Idaho River Basins. Unpublished File Data, Idaho Department of Fish and Game, Lewiston, ID.

Jackson, A. D., P. D. Kissner, D. R. Hatch, B. L Parker, M. S. Fitzpatrick, D. A. Close, and H. Li. 1996. Pacific Lamprey Research and Restoration Annual Report 1996. U. S. Department of Energy. Bonneville Power Administration. Portland OR.

Jackson, A. D., D. R. Hatch, B. L. Parker, D. A. Close, M. S. Fitzpatrick, and H. Li. Pacific Lamprey Research and Restoration Annual Report 1997. U. S. Department of Energy. Bonneville Power Administration. Portland, OR.

Keating, J. 1958. Clearwater river Investigations, Trout Mitigation Studies. Final Report 15-R, Federal Aid to Fisheries Project. Idaho Department of Fish and Game. Boise, ID.

Kruse, G. K. and W. A. Hubert. 1997. Proposed standard weight (Ws) equations for interior cutthroat trout. North American Journal of Fisheries Management 17:784-790.

Lichatowich, J. 1999. Salmon Without Rivers A History of the Pacific Salmon Crisis. Island Press. Covelo, CA.

Merrell, T. R. 1958. Gull Food Habits on the Columbia River. Research Briefs, Fish Commission of Oregon. Portland, OR.

Millemann, R. E. and S. E. Knapp. 1970. Pathogenicity of the “salmon poisoning” trematode *Nanophyetus salmincola* to fish. Pages 209-217. In: S. F. Snieszko, ed. A symposium on diseases of fishes and shellfishes. Special Publ. No. 5. American Fisheries Society, Washington D.C..

Moser, M. L., A. L. Matter, L. C. Stuehrenberg, and T. C. Bjornn. 2002. Use of an extensive radio receiver network to document Pacific lamprey *Lampetra tridentata* entrance efficiency at fishways in the lower Columbia River. Hydrobiologia 483:45-53.

Mormon, R. H. 1987. Relationship of density to growth and metamorphosis of caged sea lampreys, *Petromyzon marinus* Linnaeus, in Michigan streams. Journal of Fish Biology 30:173-181.

Murphy, B. R., D. W. Willis, and T. A. Springer. 1991. The relative weight index in fisheries management: status and needs. Fisheries 16(2):3038.

Newcomb, T. W., G. A. Snell, and F. William Wknitz. 1991. Survival of Coho Salmon smolts in salt water following exposure to cercaria of the salmon poisoning fluke, *Nanophyetus salmincola*. In: Proceedings of 42nd annual Northwest Fish Culture Conference, Redding, CA.

LITERATURE CITED, Continued

Scott, W. B., and E. J. Crossman. 1998. Freshwater Fishes of Canada. Fisheries Research Board of Canada Bulletin 184:42-45.

Simpson, J. C., and R. L. Wallace. 1982. Fishes of Idaho. University of Idaho Press. Moscow, Idaho.

Sprague, S., and R. Johnson. 2004. Nez Perce Tribal Fisheries Chinook Salmon and Steelhead Trout Monitoring. Unpublished Field Operations Data. Nez Perce Tribe, Lapwai, ID.

USACE 1995-2006. U.S. Army Corps of Engineers Annual Fish Passage Reports, Columbia and Snake River Projects. North Pacific Division U.S. Army Engineer Districts, Portland, OR and Walla Walla, WA.

Vella, J. J., L. C. Stuehrenberg, and T. C. Bjornn. 1997. Migration Patterns of Pacific Lamprey *Lampetra tridentata* In the Lower Columbia River 1997. Annual Report of Research. U. S. Army Corps of Engineers.

White, C. R. 1954. The Age, Growth, and Migration of Steelhead Trout in the Clearwater River, ID. University of Idaho, M. S. Thesis. Moscow, ID.

Wood, E. M. and W. T. Yasutake. 1956. Histopathology of fish. II. The salmon-poisoning fluke. Prog. Fish-Cult. 18:22-25.

APPENDICES

Appendix A. Pacific lamprey length and weight information from Red River, ID, 2006.

Date Electrofished	Rkm/ Reach	Area Fished (m^2)	Time Fished (min)	Lamprey Captured	Lamprey Measured	Length (mm)	Weight (g)	Phase[1]
8-27-06	3.43	7.4	6.5	4	4	168	8.0	U
						172	8.0	U
						175	9.3	U
						172	7.4	U
7-20-06	7.00	5.3	5.2	1	0	-	-	-
7-09-06	7.20	10.6	7.6	1	1	165	7.6	U
7-20-06	6.40	3.6	4.7	1*	0	-	-	-

* Lamprey caught outside the measured area.
[1] T – transformed; U – untransformed.

Appendix B. Pacific lamprey length and weight information from S.F.Clearwater River, ID, 2006.

Date Electrofished	Rkm/ Reach	Area Fished (m^2)	Time Fished (min)	Lamprey Captured	Lamprey Measured	Length (mm)	Weight (g)	Phase[1]
8-27-06	Crooked River Bridge	5.3	8.78	31	31	55	-	U
						75	0.7	U
						76	0.9	U
						81	1.2	U
						82	0.8	U
						83	1.1	U
						84	1.2	U
						84	1.0	U
						85	1.0	U
						85	1.7	U
						86	1.0	U
						87	1.2	U
						87	1.4	U
						88	1.2	U
						88	0.9	U
						90	1.2	U
						90	1.4	U
						92	1.4	U
						92	1.3	U
						93	1.5	U
						93	1.5	U
						95	1.5	U
						96	1.7	U
						98	1.7	U
						98	2.0	U
						99	1.6	U
						102	2.1	U
						102	1.6	U
						103	1.9	U
						104	2.0	U
						107	2.3	U
8-26-06	~300M Above Cougar Ck	5.0	4.92	8	8	27	-	U
						30	-	U
						32	-	U
						61	0.7	U
						65	0.5	U
						67	-	U
						70	0.8	U
						164	6.0	U
8-26-06	~30M ABOVE John's Ck	3.0	5.92	12	12	53	0.4	U
						56	0.5	U
						61	0.4	U
						70	-	U
						70	0.7	U
						77	0.9	U
						78	0.8	U
						79	1.1	U
						80	1.0	U
						87	1.0	U
						91	1.0	U
						144	5.2	T
8-26-06	.8KM Below Castle Ck	2.6	2.13	85	85	15	-	U
						39	-	U
						41	-	U
						42	-	U
						42	-	U
						43	-	U
						44	-	U
						45	-	U
						45	-	U

Appendix B. Continued.

Date Electrofished	Rkm/ Reach	Area Fished (m^2)	Time Fished (min)	Lamprey Captured	Lamprey Measured	Length (mm)	Weight (g)	Phase[1]
Continued	.8KM Below Castle Ck					47	-	U
						47	-	U
						47	-	U
						48	-	U
						48	-	U
						49	-	U
						49	-	U
						49	-	U
						49	-	U
						50	-	U
						50	-	U
						50	-	U
						50	-	U
						50	-	U
						50	-	U
						51	-	U
						51	-	U
						51	-	U
						52	-	U
						52	-	U
						52	-	U
						53	-	U
						53	-	U
						53	-	U
						53	-	U
						54	-	U
						54	-	U
						54	-	U
						54	-	U
						54	-	U
						54	-	U
						55	-	U
						55	-	U
						55	-	U
						56	-	U
						56	-	U
						56	-	U
						56	-	U
						56	-	U
						56	-	U
						57	-	U
						57	-	U
						58	-	U
						60	-	T
						60	-	U
						61	-	U
						62	-	U
						63	-	U
						63	0.4	U
						65	-	U
						65	-	U
						65	-	U
						67	-	U
						67	-	U
						67	-	U
						69	-	U
						70	-	U
						73	-	U
						75	-	U
						75	-	U
						76	-	U

Appendix B. Continued.

Date Electrofished	Rkm/ Reach	Area Fished (m^2)	Time Fished (min)	Lamprey Captured	Lamprey Measured	Length (mm)	Weight (g)	Phase[1]
Continued	.8KM Below Castle Ck					76	-	U
						85	0.8	U
						88	-	U
						94	1.5	U
						95	1.4	U
						96	1.8	U
						96	-	U
						96	-	U
						97	-	U
						98	1.4	U
						100	1.7	U
						101	1.9	U
						108	2.0	U
						119	-	U
						123	-	U

[1] T -Transformed; U – Untransformed.

Appendix C. Pacific lamprey length and weight information for M.F. Clearwater River, ID, 2006.

Date Electrofished	Rkm/ Reach	Area Fished (m^2)	Time Fished (min)	Lamprey Captured	Lamprey Measured	Length (mm)	Weight (g)	Phase[1]
9-21-06	~150m Below Three Devils Ck	4.0	5.9	24	24	48	-	U
						57	-	U
						59	-	U
						66	-	U
						70	0.7	U
						74	-	U
						75	0.7	U
						75	-	U
						75	-	U
						76	0.6	U
						77	0.7	U
						80	0.7	U
						81	0.9	U
						84	0.7	U
						85	-	U
						85	-	U
						87	-	U
						90	1.1	U
						94	-	U
						95	-	U
						98	1.4	U
						102	1.7	U
						105	-	U
						117	2.6	U
9-18-06	Five Mile Boat Launch	2.6	2.8	5/*11	16	71	-	U
						74	-	U
						87	-	U
						87	-	U
						90	-	U
						96	-	U
						98	-	U
						10	-	U
						103	-	U
						105	-	U
						107	-	U
						111	-	U
						111	-	U
						115	-	U
						117	-	U
						118	-	U

* Lamprey caught outside the measured area.

[1] T -Transformed; U – Untransformed.

Appendix D. Pacific lamprey length and weight information for Selway River, ID, 2006.

Date Electrofished	Rkm/ Reach	Area Fished (m^2)	Time Fished (min)	Lamprey Captured	Lamprey Measured	Length (mm)	Weight (g)	Phase[1]
8-31-06	~150m Below Slide Ck	2.0	3.6	28	28	49	0.3	U
						54	0.3	U
						57	0.4	U
						58	0.6	U
						58	-	U
						60	0.4	U
						60	0.5	U
						64	0.6	U
						65	0.5	U
						68	0.6	U
						69	0.7	U
						69	0.7	U
						71	0.8	U
						72	0.6	U
						74	0.9	U
						74	0.7	U
						75	0.5	U
						77	0.8	U
						78	0.8	U
						81	1.1	U
						83	1.2	U
						85	1.3	U
						85	1.0	U
						86	1.3	U
						86	1.0	U
						97	1.6	U
						104	1.9	U
						113	2.5	U
8-30-06	3.8km Below Gedney Ck	3.0	4.7	43	43	25	-	U
						41	-	U
						42	-	U
						44	-	U
						45	-	U
						46	-	U
						50	-	U
						51	-	U
						53	-	U
						55	-	U
						57	-	U
						59	-	U
						60	-	U
						61	-	U
						61	-	U
						62	-	U
						63	-	U
						63	-	U
						64	-	U
						64	-	U
						64	-	U
						65	-	U
						65	-	U
						65	-	U
						65	-	U
						65	-	U
						66	-	U
						66	-	U
						67	-	U
						67	-	U
						68	-	U
						68	-	U
						68	-	U

Appendix D. Continued.

Date Electrofished	Rkm/ Reach	Area Fished (m^2)	Time Fished (min)	Lamprey Captured	Lamprey Measured	Length (mm)	Weight (g)	Phase[1]
Continued	3.8km Below Gedney Ck					71	-	U
						75	-	U
						75	-	U
						77	-	U
						79	-	U
						80	-	U
						82	-	U
						83	-	U
						84	-	U
						85	-	U
8-30-06	~150m Above Gedney Ck	6.0	11.6	42	42	46	-	U
						46	-	U
						47	-	U
						49	-	U
						49	-	U
						49	-	U
						50	-	U
						50	-	U
						50	-	U
						50	-	U
						51	-	U
						52	-	U
						52	-	U
						53	-	U
						53	-	U
						53	-	U
						54	-	U
						55	-	U
						55	-	U
						55	-	U
						56	-	U
						56	-	U
						57	-	U
						57	-	U
						60	-	U
						60	-	U
						62	-	U
						64	-	U
						64	-	U
						64	-	U
						65	0.6	U
						65	0.5	U
						65	-	U
						67	-	U
						70	-	U
						84	-	U
						93	-	U
						64	1.4	U
						98	-	U
						110	-	U
						123	2.9	U
						127	-	U
8-30-06	Johnson Bar	1.0	1.9	6	6	71	-	U
						72	-	U
						82	-	U
						108	-	U
						115	-	U
						123	-	U
9-20-06	1.0km Above Mouth of Meadow Ck	10.5	13.0	44	44	45	-	U
						45	-	U
						47	0.3	U

Appendix D. Continued.

Date Electrofished	Rkm/ Reach	Area Fished (m^2)	Time Fished (min)	Lamprey Captured	Lamprey Measured	Length (mm)	Weight (g)	Phase[1]
Continued	1.0km Above Mouth of Meadow Ck					47	-	U
						47	-	U
						61	0.4	U
						64	0.4	U
						64	0.4	U
						68	0.4	U
						70	0.5	U
						70	0.5	U
						70	0.7	U
						70	0.9	U
						73	0.5	U
						73	0.7	U
						74	0.8	U
						75	0.7	U
						75	0.8	U
						75	1.0	U
						75	-	U
						76	0.6	U
						77	0.7	U
						79	1.2	U
						80	1.0	U
						80	1.1	U
						82	1.0	U
						83	1.1	U
						84	1.0	U
						84	1.0	U
						85	1.3	U
						86	0.9	U
						86	1.1	U
						87	0.9	U
						90	1.2	U
						91	1.2	U
						94	-	U
						96	1.3	U
						97	1.2	U
						97	1.8	U
						103	2.0	U
						106	1.8	U
						115	2.3	U
						126	3.2	U
						130	3.8	U

[1] T -Transformed; U – Untransformed.

Appendix E. Pacific lamprey length and weight for Lochsa River, ID, 2006

Date Electrofished	Rkm/ Reach	Area Fished (m^2)	Time Fished (min)	Lamprey Captured	Lamprey Measured	Length (mm)	Weight (g)	Phase[1]
8-31-06	0.85km Below Fire Ck	1.0	0.28	83	83	37	-	U
						37	-	U
						40	-	U
						43	-	U
						45	-	U
						47	-	U
						47	-	U
						48	-	U
						48	-	U
						49	0.3	U
						50	-	U
						50	-	U
						50	-	U
						52	-	U
						52	-	U
						53	-	U
						53	-	U
						53	-	U
						54	-	U
						55	-	U
						55	-	U
						55	-	U
						56	-	U
						56	-	U
						56	-	U
						57	-	U
						57	-	U
						58	-	U
						59	-	U
						59	0.5	U
						59	-	U
						59	-	U
						60	-	U
						60	-	U
						61	0.4	U
						61	0.4	U
						63	0.4	U
						63	0.4	U
						64	-	U
						64	-	U
						65	-	U
						65	0.5	U
						65	-	U
						66	-	U
						68	-	U
						69	-	U
						70	0.7	U
						70	--	U
						71	0.6-	U
						71	--	U
						72	--	U
						72	--	U
						72	--	U
						72	--	U
						72	--	U
						73	-	U
						73	--	U
						43	--	U
						74	1.2-	U
						74	--	U
						74	--	U

Appendix E. Continued.

Date Electrofished	Rkm/ Reach	Area Fished (m^2)	Time Fished (min)	Lamprey Captured	Lamprey Measured	Length (mm)	Weight (g)	Phase[1]
Continued	0.85km Below Fire Ck					75	0.9	U
						75	-	U
						76	-	U
						76	-	U
						83	-	U
						85	1.0	U
						86	-	U
						86	1.2	U
						89	-	U
						92	1.5	U
						95	-	U
						95	-	U
						96	-	U
						97	-	U
						97	-	U
						97	-	U
						99	-	U
						100	-	U
						100	-	U
						101	1.6	U
						108	-	U
						110	2.4	U
9-19-06	1.0km Above Castle Ck	4.0	3.85	18	18	58	-	U
						80	-	U
						80	-	U
						84	-	U
						85	-	U
						87	-	U
						89	-	U
						93	-	U
						95	-	U
						96	-	U
						98	-	U
						99	-	U
						101	-	U
						106	-	U
						108	-	U
						109	-	U
						115	-	U
						123	-	U
9-19-06	1.5km Below Weir Ck	5.0	4.75	6	6	64	-	U
						78	-	U
						87	-	U
						92	-	U
						96	-	U
						98	-	U
9-20-06	0.5km Above Fish Ck	2.0	16.13	64	64	45	-	U
						46	-	U
						46	-	U
						46	-	U
						47	-	U
						48	-	U
						51	-	U
						53	-	U
						54	-	U
						54	-	U
						55	-	U
						56	-	U
						56	-	U
						58	-	U
						59	-	U

Appendix E. Continued.

Date Electrofished	Rkm/ Reach	Area Fished (m^2)	Time Fished (min)	Lamprey Captured	Lamprey Measured	Length (mm)	Weight (g)	Phase[1]
Continued	0.5km Above Fish Ck					59	-	U
						60	0.5	U
						60	-	U
						60	0.4	U
						60	-	U
						61	0.4	U
						61	0.5	U
						61	-	U
						62	-	U
						62	-	U
						63	-	U
						64	-	U
						64	0.6	U
						65	0.4	U
						65	-	U
						67	0.6	U
						67	-	U
						67	0.6	U
						68	-	U
						70	0.7	U
						70	0.7	U
						70	0.7	U
						70	0.7	U
						70	-	U
						72	0.5	U
						72	0.7	U
						72	0.6	U
						73	0.6	U
						73	0.7	U
						74	0.7	U
						74	-	U
						74	0.6	U
						75	-	U
						76	0.7	U
						77	-	U
						78	-	U
						78	0.7	U
						79	0.7	U
						80	0.9	U
						81	0.8	U
						85	1.0	U
						85	1.3	U
						86	1.1	U
						90	0.9	U
						91	1.2	U
						96	1.4	U
						99	1.4	U
						102	1.8	U
						107	2.0	U

[1] T -Transformed; U – Untransformed.

Appendix F. Pacific lamprey length and weight information for mainstem Salmon River, ID, 2006.

Date Electrofished	Rkm/ Reach	Area Fished (m^2)	Time Fished (min)	Lamprey Captured	Lamprey Measured	Length (mm)	Weight (g)	Phase[1]
10-01-06	~250km Above Elkhorn Ck	4.0	5.8	8/*25	33	58	-	U
						61	0.5	U
						65	0.7	U
						66	0.7	U
						68	0.6	U
						70	0.5	U
						71	0.5	U
						72	0.8	U
						72	0.7	U
						74	0.7	U
						75	0.8	U
						82	1.1	U
						85	1.1	U
						86	1.2	U
						91	1.2	U
						98	1.4	U
						104	1.6	U
						104	1.9	U
						105	1.8	U
						106	2.1	U
						106	1.9	U
						109	2.0	U
						109	2.0	U
						110	2.4	U
						110	2.1	U
						111	1.7	U
						111	2.5	U
						112	2.4	U
						120	2.6	U
						120	2.8	U
						120	2.8	U
						121	2.8	U
						122	3.3	U
8-19-06	Indian Ck at Indianola (Gravel Area)	2.3	2.0	2	2	123	3.0	U
						132	2.8	U
8-19-06	Indian Ck at Indianola (Beach)	2.0	3.9	13	13	28	-	U
						72	-	U
						75	1.1	U
						76	-	U
						83	1.4	U
						83	0.7	U
						84	-	U
						86	-	U
						87	-	U
						89	0.8	U
						89	0.8	U
						125	3.9	U
						130	2.8	U
8-19-06	.66km Below N.F. Salmon River	5.0	4.8	4	4	124	-	U
						132	-	U
						134	-	U
						145	-	U
7-21-06	Mackay Bar	3.0	5.6	16	16	45	-	U
						48	-	U
						56	-	U
						57	-	U
						78	-	U
						78	-	U
						82	0.8	U
						83	-	U
						84	-	U

Appendix F. Continued.

Date Electrofished	Rkm/ Reach	Area Fished (m^2)	Time Fished (min)	Lamprey Captured	Lamprey Measured	Length (mm)	Weight (g)	Phase[1]
Continued	Mackay Bar					89	-	U
						90	-	U
						96	1.1	U
						96	-	U
						66	1.9	U
						100	1.9	U
						115	-	U
10-01-06	~150m Below Fall Ck	6.3	7.9	37	37	32	-	U
						34	-	U
						34	-	U
						35	-	U
						55	0.3	U
						56	-	U
						59	0.3	U
						61	-	U
						62	0.3	U
						63	0.4	U
						64	0.5	U
						64	0.5	U
						66	0.6	U
						66	0.5	U
						66	0.5	U
						66	0.5	U
						67	0.6	U
						68	0.4	U
						68	0.5	U
						68	0.5	U
						69	0.6	U
						69	0.7	U
						72	0.7	U
						72	-	U
						74	0.5	U
						75	0.5	U
						76	0.9	U
						76	0.7	U
						81	0.9	U
						94	1.3	U
						95	1.7	U
						105	1.4	U
						106	1.6	U
						108	1.6	U
						109	2.0	U
						111	1.9	U
09-30-06	~15m Above Lucile Boat Launch	8.0	5.5	2	2	100	-	U
						91	-	U
10-04-06	1.0km Above Whitewater Ranch	2.0	3.5	8	8	62	-	U
						67	-	U
						76	-	U
						84	-	U
						84	-	U
						86	-	U
						95	-	U
						96	-	U
06-28-06	150M Above Corn Creek Boat launch	8.0	6.6	~16**	8	74	-	U
						85	-	U
						85	-	U
						91	0.6	U
						92	-	U
						96	-	U
						101	1.7	U
						106	1.5	U
						112	-	U

Appendix F. Continued.

Date Electrofished	Rkm/ Reach	Area Fished (m^2)	Time Fished (min)	Lamprey Captured	Lamprey Measured	Length (mm)	Weight (g)	Phase[1]
08-20-06	.37km Above Owl Creek	4.0	7.6	56	56	55	-	U
						62	0.4	U
						62	0.4	U
						63	-	U
						64	-	U
						65	0.8	U
						67	-	U
						68	-	U
						68	0.5	U
						70	0.6	U
						70	0.5	U
						70	0.4	U
						71	0.6	U
						71	0.5	U
						71	0.5	U
						71	-	U
						72	-	U
						73	-	U
						73	-	U
						74	0.7	U
						74	-	U
						75	0.7	U
						76	0.8	U
						77	-	U
						80	0.7	U
						80	0.9	U
						80	-	U
						81	0.7	U
						83	1.3	U
						85	1.2	U
						88	1.5	U
						93	1.2	U
						96	1.3	U
						101	1.6	U
						103	1.6	U
						104	1.4	U
						105	1.8	U
						105	2.2	U
						105	2.4	U
						108	2.0	U
						108	2.0	U
						109	2.0	U
						110	2.2	U
						111	2.2	U
						115	2.3	U
						116	1.9	U
						116	2.3	U
						117	2.4	U
						120	2.5	U
						124	2.9	U
						125	2.6	U
						125	2.6	U
						126	3.3	U
						128	-	U
						130	3.2	U
						132	3.5	U
08-20-06	3.3km Above Panther Ck	1.3	4.8	23	23	22	-	U
						65	0.5	U
						65	0.6	U
						65	0.8	U
						67	0.8	U
						68	1.0	U

Appendix F. Continued.

Date Electrofished	Rkm/ Reach	Area Fished (m^2)	Time Fished (min)	Lamprey Captured	Lamprey Measured	Length (mm)	Weight (g)	Phase[1]
Continued	3.3km Above Panther Ck					70	0.8	U
						71	-	U
						73	-	U
						74	-	U
						74	-	U
						77	1.0	U
						83	-	U
						94	-	U
						95	1.2	U
						98	1.6	U
						101	1.6	U
						103	1.4	U
						103	1.7	U
						105	1.8	U
						106	-	U
						106	1.7	U
						116	1.8	U
08-19-06	~350m Above Shoup	3.0	5.8	17	17	75	-	U
						76	-	U
						84	-	U
						84	-	U
						85	-	U
						88	-	U
						88	-	U
						89	-	U
						90	-	U
						91	-	U
						96	-	U
						99	-	U
						102	-	U
						110	-	U
						126	-	U
						128	-	U
						130	-	U
10-15-06	Below Partridge Creek	5.3	2.5	1/*13	14	78	-	U
						80	-	U
						91	-	U
						97	-	U
						104	-	U
						108	-	U
						108	-	U
						109	-	U
						111	-	U
						112	-	U
						113	-	U
						120	-	U
						121	-	U
						128	-	U
10-14-06	250m Above Elkhorn Ck	***	-	62	62	64	-	U
						65	-	U
						65	-	U
						66	-	U
						66	-	U
						67	-	U
						67	-	U
						68	-	U
						68	-	U
						69	-	U
						70	0.5	U
						73	-	U
						74	-	U
						74	-	U

Appendix F. Continued.

Date Electrofished	Rkm/ Reach	Area Fished (m^2)	Time Fished (min)	Lamprey Captured	Lamprey Measured	Length (mm)	Weight (g)	Phase[1]
Continued	250m Above Elkhorn Ck					75	-	U
						76	-	U
						77	-	U
						77	0.8	U
						78	-	U
						78	-	U
						80	-	U
						80	-	U
						83	-	U
						84	-	U
						84	-	U
						85	-	U
						87	0.9	U
						87	-	U
						90	-	U
						96	-	U
						97	1.5	U
						97	-	U
						100	-	U
						102	-	U
						103	-	U
						104	-	U
						105	1.7	U
						106	-	U
						106	-	U
						107	-	U
						108	-	U
						109	-	U
						109	-	U
						110	2.2	U
						110	-	U
						110	-	U
						110	-	U
						111	-	U
						112	-	U
						113	-	U
						113	2.5	U
						113	-	U
						113	-	U
						114	2.3	U
						114	-	U
						114	-	U
						115	-	U
						116	-	U
						116	-	U
						118	-	U
						120	-	U
						121	-	U

* Lamprey captured outside the measured area.
** Estimate we captured 16, but about 8 got out of the bucket (only 8 actually measured).
[1] T -Transformed; U – Untransformed.

Appendix G. Pacific lamprey length and weight information for M.F. Salmon River, ID, 2006.

Date Electrofished	Rkm/ Reach	Area Fished (m^2)	Time Fished (min)	Lamprey Captured	Lamprey Measured	Length (mm)	Weight (g)	Phase[1]
10-24-06	0.9km Below Loon Creek (rkm 72.3)	6	9.93	37	37	109	-	U
						106	-	U
						99	-	U
						100	-	U
						114	-	U
						106	-	U
						96	-	U
						78	-	U
						120	-	U
						116	-	U
						114	-	U
						114	-	U
						116	-	U
						93	-	U
						91	-	U
						113	-	U
						58	-	U
						107	-	U
						116	-	U
						106	-	U
						88	-	U
						114	-	U
						112	-	U
						77	-	U
						101	-	U
						88	-	U
						93	-	U
						100	-	U
						96	-	U
						108	-	U
						93	-	U
						112	-	U
						106	-	U
						112	-	U
						65	-	U
						73	-	U
						77	-	U
10-24-06	Upper Goose Camp	1	4.42	6	0	-	-	-
10-25-06	30m Above Camas Creek	4	4.3	8	8	61	-	U
						92	-	U
						118	-	U
						76	-	U
						78	-	U
						81	-	U
						61	-	U
						50	-	U
10-26-06	Beach Above Aparejo Point Rapida	7	8.75	20/*37	57	78	-	U
						74	-	U
						76	-	U
						115	-	U
						108	-	U
						109	-	U
						87	-	U
						104	-	U
						102	-	U
						87	-	U
						85	-	U
						62	-	U
						87	-	U
						88	-	U
						98	-	U

Appendix G. Continued.

Date Electrofished	Rkm/ Reach	Area Fished (m^2)	Time Fished (min)	Lamprey Captured	Lamprey Measured	Length (mm)	Weight (g)	Phase[1]
Continued	Beach Above Aparejo Point Rapida					64	-	U
						87	-	U
						64	-	U
						93	-	U
						65	-	U
						110	-	U
						110	-	U
						108	-	U
						90	-	U
						102	-	U
						88	-	U
						92	-	U
						117	-	U
						75	-	U
						103	-	U
						99	-	U
						109	-	U
						83	-	U
						115	-	U
						101	-	U
						92	-	U
						88	-	U
						91	-	U
						89	-	U
						87	-	U
						101	-	U
						80	-	U
						78	-	U
						95	-	U
						92	-	U
						78	-	U
						96	-	U
						74	-	U
						121	-	U
						80	-	U
						89	-	U
						106	-	U
						83	-	-
						77	-	U
						86	-	U
						87	-	U
						114	-	U
10-26-06	Mormon Ranch (Site 1) rkm 48.3	5	5.08	18	18	96	-	U
						90	-	U
						101	-	U
						83	-	U
						100	-	U
						99	-	U
						82	-	U
						76	-	U
						75	-	U
						83	-	U
						82	-	U
						115	-	U
						114	-	U
						83	-	U
						103	-	U
						84	-	U
						76	-	U
						62	-	U
10-26-06	Mormon Ranch (Site 2) rkm 48.3	4	6.35	25	25	118	-	U
						78	-	

Appendix G. Continued.

Date Electrofished	Rkm/ Reach	Area Fished (m^2)	Time Fished (min)	Lamprey Captured	Lamprey Measured	Length (mm)	Weight (g)	Phase[1]
Continued	Mormon Ranch (Site 2) rkm 48.3					108	-	U
						89	-	U
						85	-	U
						78	-	U
						93	-	U
						93	-	U
						97	-	U
						86	-	U
						60	-	U
						84	-	U
						78	-	U
						82	-	U
						114	-	U
						108	-	U
						112	-	U
						84	-	U
						84	-	U
						72	-	U
						89	-	U
						81	-	U
						81	-	U
						95	-	U
						82	-	U

* Lamprey captured outside the measured area.

[1] T -Transformed; U – Untransformed.

Appendix H. Pacific lamprey population trend and surveys in Red River, S.F. Clearwater River watershed, ID, 2006.

Date	Time	Stream	Rkm Description	Air Temp (°C)	Stream Temp (°C)	Electro-Fished Time (Min)	Lamprey Captured	Depth Average (m)	Shade (%)
7-06-06	1145	Red River	Rkm 0.6	24.0	17.0	4.9	0	0.48	5.9
7-06-06	0943	Red River	Rkm 5.0	21.0	14.5	7.0	0	0.35	27.9
7-06-06	0748	Red River	Rkm 8.0	15.0	13.0	5.5	0	0.49	1.5
7-08-06	0925	Red River	0.1 km Above Dawson Ck	16.5	14.0	3.3	0	0.33	14.7
7-09-06	0910	Red River	Rkm 7.2	16.0	15.5	7.6	1	0.31	7.4
7-09-06	0805	Red River	1.6 km Above Red Horse Ck	14.0	14.5	3.0	0	0.51	0.0
7-09-06	0815	Red River	1.6 km Above Red Horse Ck	14.0	14.5	4.5	0	0.34	5.9
7-20-06	0952	Red River	Rkm 0.99	21.0	17.0	2.7	0	0.18	14.7
7-20-06	0740	Red River	Rkm 6.0	12.5	16.0	3.6	0	0.26	4.4
7-20-06	0650	Red River	Rkm 7.0	10.5	16.0	5.2	1	0.34	11.8
7-20-06	0830	Red River	Rkm 6.4	15.0	16.0	4.7	1/1**	0.16	7.4
8-27-06	1438	Red River	Rkm 0.7	24.0	17.0	2.8	0	0.49	0.0
8-27-06	1241	Red River	Rkm 3.43	24.0	16.0	6.5	4/3**	0.28	30.9
7-22-06	0735	S.F. Red River	0.9 km Above Trapper Ck	16.0	13.0	2.3	0	0.23	10.29

* Lamprey captured outside the measured area.
** Lamprey observed, unmeasured.

Appendix I. Pacific lamprey population trend and survey habitat descriptors, Red River, S.F. Clearwater River watershed, ID, 2006.

PERSONNEL: Hyatt, Licht		DOMINANT SUBSTRATE PERCENT									
RKM/DESCRIPTION	E. FISHED AREA (m^2)	SILT ORG.	FINE SAND	CRSE. SAND	FINE GRVL.	MED. GRVL.	CRSE. GRVL.	CBLE.	SM. BLDR.	LG. BLDR.	OTHER
RKM 0.6	6.8	5.0	26.0	58.0	0.0	0.0	0.0	3.0	3.0	5.0	0.0
RKM 5.0	7.4	43.0	5.0	2.0	5.0	3.0	2.0	8.0	10.0	22.0	0.0
RKM 8.0	4.0	21.0	4.0	8.0	4.0	4.0	4.0	16.0	9.0	30.0	0.0
0.1 km abve. Dawson Crk	5.3	2.0	8.0	17.0	5.0	15.0	50.0	3.0	0.0	0.0	0.0
RKM 7.2	10.6	12.0	18.0	17.0	3.0	0.0	0.0	40.0	6.0	4.0	0.0
1.6 km abve. Red Horse Crk	4.0	5.0	20.0	55.0	10.0	0.0	0.0	1.0	0.0	10.0	0.0
1.6 km abve. Red Horse Crk	5.3	50.0	10.0	29.0	10.0	0.0	0.0	1.0	0.0	0.0	0.0
RKM 0.99	5.0	20.0	35.0	15.0	3.0	2.0	0.0	0.0	15.0	10.0	0.0
RKM 6.0	4.1	90.0	0.0	0.0	0.0	0.0	3.0	7.0	0.0	0.0	0.0
RKM 7.0	5.3	20.0	3.0	7.0	5.0	5.0	5.0	15.0	5.0	35.0	0.0
RKM 6.4	3.6	45.0	5.0	10.0	8.0	7.0	10.0	15.0	0.0	0.0	0.0
RKM 0.7	4.0	20.0	3.0	11.0	33.0	5.0	10.0	3.0	0.0	15.0	0.0
RKM 3.43	7.4	5.0	16.0	25.0	20.0	4.0	1.0	4.0	5.0	20.0	0.0
0.9 km abve. Trapper Creek*	3.0	2.0	12.0	45.0	9.0	8.0	8.0	8.0	8.0	0.0	0.0

(* Site was on S.F. Red River)

Appendix J. Pacific lamprey population trend and surveys in S.F. Clearwater River watershed, ID, 2006.

DATE	TIME	STREAM	RKM/DESCRIPTION	AIR TEMP (°C)	STREAM TEMP (°C)	E.FISHED TIME (min)	LAMPREY CAPTURED	DEPTH AVE. (m)	SHADE (%)
7/10/2006	1105	Meadow Crk	McComas Meadow at Bridge	19.0	15.5	3.2	0	0.30	100.0
7/7/2006	1110	Ten-Mile Crk	100m blw. Sourdough Rd Brdg	19.5	12.0	2.0	0	0.18	11.8
7/7/2006	1315	American R.	BLM day picnic site E. Elk City	23.0	17.5	5.1	0	0.30	0.0
7/7/2006	0925	Newsome Crk	2.25 km up Newsome Crk Rd	18.0	13.0	2.4	0	0.39	23.5
7/7/2006	0805	Crooked R.	1.2 km abve. IDFG Weir	13.0	12.5	4.8	0	0.29	0.0
7/9/2006	1200	Leggett Crk	2.1 km above mouth	24.0	14.5	2.1	0	0.20	20.6
8/26/2006	1433	S.F. Clearwater	Mile Marker 38	21.0	17.5	4.5	0	0.43	2.9
8/27/2006	1011	S.F. Clearwater	Crooked R. Bridge	26.0	14.0	8.8	31	0.48	5.9
8/26/2006	1302	S.F. Clearwater	300 m abve. Cougar Crk	25.0	15.5	4.9	8	0.34	0.0
8/26/2006	1142	S.F. Clearwater	30 m abve. Johns Crk	21.0	15.0	5.9	12	0.38	4.4
8/26/2006	0815	S.F. Clearwater	.80 km below Cst. Crk Cpgd.	11.0	13.0	2.1	85	0.20	2.9

Appendix K. Pacific lamprey population trend and survey habitat descriptors, S.F. Clearwater River watershed, ID, 2006.

PERSONNEL: Hyatt, Licht			DOMINANT SUBSTRATE PERCENT									
STREAM	RKM/DESCRIPTION	E. FISHED AREA (m^2)	SILT ORG.	FINE SAND	CRSE. SAND	FINE GRVL.	MED. GRVL.	CRSE. GRVL.	CBLE.	SM. BLDR.	LG. BLDR.	OTHER
Meadow Crk	McComas Meadow at Brdg.	3.3	98.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	0.0	0.0
Ten-Mile Crk	100m blw. Sourdh. Rd Brdg	3.0	0.0	6.0	11.0	5.0	15.0	10.0	25.0	3.0	20.0	0.0
American R.	BLM day picnic site E. Elk Cty.	11.0	0.0	30.0	50.0	7.0	12.0	1.0	0.0	0.0	0.0	0.0
Newsome Crk	2.25 km up Newsome Crk Rd	4.0	1.0	2.0	2.0	75.0	15.0	5.0	0.0	0.0	0.0	0.0
Crooked R.	1.2 km abve. IDFG Weir	6.1	1.0	2.0	7.0	5.0	5.0	50.0	25.0	5.0	0.0	0.0
Leggett Crk	2.1 km above mouth	2.0	35.0	30.0	25.0	7.0	1.0	0.0	2.0	0.0	0.0	0.0
S.F. Clearwater	Mile Marker 38	5.0	12.0	0.0	0.0	1.0	2.0	15.0	42.0	20.0	8.0	0.0
S.F. Clearwater	Crooked R. Bridge	5.3	25.0	2.0	3.0	14.0	1.0	5.0	40.0	10.0	0.0	0.0
S.F. Clearwater	300 m abve. Cougar Crk	5.0	20.0	22.0	55.0	2.0	0.0	0.0	1.0	0.0	0.0	0.0
S.F. Clearwater	30 m abve. Johns Crk	3.0	5.0	18.0	36.0	10.0	5.0	8.0	6.0	7.0	5.0	0.0
S.F. Clearwater	.80 km below Cst. Crk Cmgd	2.6	60.0	15.0	2.0	2.0	0.0	0.0	1.0	20.0	0.0	0.0

Appendix L. Pacific lamprey population trend and surveys in Selway River watershed, ID, 2006.

DATE	TIME	STREAM	RKM/DESCRIPTION	AIR TEMP (°C)	STREAM TEMP (°C)	E.FISHED TIME (min)	LAMPREY CAPTURED	DEPTH AVE. (m)	SHADE (%)
8/30/2006	0930	Meadow Crk.	0.6km abve. Mouth	14.0	14.5	5.3	0	0.26	0.0
8/31/2006	1013	Selway R.	150m blw. Slide Crk.	18.5	16.0	3.6	28	0.28	0.0
7/25/2006	0800	Gedney Crk.	at the mouth	18.0	16.5	4.1	0	0.29	1.5
8/30/2006	0835	Selway R.	0.3km blw. Race Crk.	13.5	17.0	2.8	0	0.20	4.4
8/30/2006	1312	Selway R.	3.8km blw. Gedney Crk.	14.0	16.0	4.7	43	0.18	0.0
8/30/2006	1030	Selway R.	150m abv. Gedney Crk	14.0	17.0	11.6	42	0.18	10.3
8/30/2006	1525	Selway R.	Johnson Bar	14.0	17.5	1.9	6	0.14	0.0
8/31/2006	0900	Selway R.	0.9km abve. Road 443 Brdg.	12.0	15.5	1.9	0	0.38	0.0
9/20/2006	1030	Selway R.	1.0km abve. Meadow Crk	10.5	11.0	13.0	44	0.43	25.0

Appendix M. Pacific lamprey population trend and survey habitat descriptors, in Selway River watershed, ID, 2006.

PERSONNEL: Hyatt, Licht, Bickford, Hanson			DOMINANT SUBSTRATE PERCENT									
STREAM	RKM/DESCRIPTION	E. FISHED AREA (m^2)	SILT ORG.	FINE SAND	CRSE. SAND	FINE GRVL.	MED. GRVL.	CRSE. GRVL.	CBLE.	SM. BLDR.	LG. BLDR.	OTHER
Meadow Crk.	0.6km abve. Mouth	7.5	15.0	12.0	8.0	17.0	8.0	20.0	17.0	3.0	0.0	0.0
Selway R.	150m blw. Slide Crk.	2.0	10.0	5.0	15.0	10.0	2.0	8.0	20.0	20.0	10.0	0.0
Gedney Crk.	at the mouth	5.3	0.0	1.0	2.0	25.0	25.0	15.0	25.0	7.0	0.0	0.0
Selway R.	0.3km blw. Race Crk.	3.0	5.0	7.0	20.0	65.0	3.0	0.0	0.0	0.0	0.0	0.0
Selway R.	3.8km blw. Gedney Crk.	3.0	5.0	23.0	22.0	5.0	2.0	3.0	15.0	25.0	0.0	0.0
Selway R.	150m abv. Gedney Crk	6.0	7.0	6.0	14.0	10.0	1.0	4.0	13.0	20.0	25.0	0.0
Selway R.	Johnson Bar	1.0	5.0	40.0	50.0	2.0	0.0	0.0	2.0	1.0	0.0	0.0
Selway R.	0.9km abve. Road 443 Brdg.	2.0	5.0	60.0	35.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Selway R.	1.0km abve. Meadow Crk	10.5	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

Appendix N. Pacific lamprey population trend and surveys in Lochsa River watershed, ID, 2006.

						E.FISHED			
DATE	TIME	STREAM	RKM/DESCRIPTION	AIR TEMP (°C)	STREAM TEMP (°C)	TIME (min)	LAMPREY CAPTURED	DEPTH AVE. (m)	SHADE (%)
8/31/2006	1232	Lochsa R	0.85 km blw. Fire Creek	23.0	16.0	0.3	83	0.16	0.0
7/24/2006	0710	Lochsa R	2.0 km abve. Squaw Creek	19.0	17.0	4.2	0	0.30	0.0
7/24/2006	1010	Pete King Crk	100m blw. 1st Bridge	21.0	17.0	2.6	0	0.34	83.8
7/24/2006	0835	Fish Crk	50m abve. mouth	21.0	17.5	2.6	0	0.24	16.2
7/23/2006	1240	Weir Crk	0.7 km abve. mouth	26.5	17.0	2.3	0	0.33	80.9
7/23/2006	0950	Crooked Fork	25m blw. 595 Rd. Brdg.	24.0	11.0	2.5	0	0.30	26.5
7/23/2006	0740	Crooked Fork	25m abve. Shotgun Crk	14.0	13.0	2.3	0	0.23	32.3
9/19/2006	1045	Wrm. Spgs. Crk	~150m abve. Mouth	13.0	10.0	2.1	0	0.18	82.3
9/19/2006	0920	Colt Killed Crk	20m abve. Bridge at mouth	13.0	8.0	1.6	0	0.16	0.0
9/19/2006	1330	Lochsa R	1km abve. Castle Crk	13.0	11.0	4.7	18	0.26	25.0
9/19/2006	1138	Lochsa R	1.5km blw. Weir Crk	14.0	12.0	4.8	6	0.26	0.0
9/20/2006	1500	Lochsa R	0.5km abve. Fish Crk	11.0	10.0	16.1	64	0.18	4.4

Appendix O. Pacific lamprey population trend and survey habitat descriptors, in Lochsa River watershed, ID, 2006.

PERSONNEL: Hyatt, Licht, Bickford, Hanson			DOMINANT SUBSTRATE PERCENT									
STREAM	RKM/DESCRIPTION	E. FISHED AREA (m^2)	SILT ORG.	FINE SAND	CRSE. SAND	FINE GRVL.	MED. GRVL.	CRSE. GRVL.	CBLE.	SM. BLDR.	LG. BLDR.	OTHER
Lochsa R	0.85 km blw. Fire Creek	1.0	20.0	65.0	15.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lochsa R	2.0 km abve. Squaw Creek	6.0	8.0	30.0	40.0	0.0	0.0	0.0	0.0	2.0	20.0	0.0
Pete King Crk	100m blw. 1st Bridge	4.5	34.0	10.0	23.0	4.0	5.0	2.0	2.0	15.0	5.0	0.0
Fish Crk	50m abve. mouth	4.2	10.0	3.0	30.0	20.0	7.0	5.0	5.0	0.0	20.0	0.0
Weir Crk	0.7 km abve. mouth	4.5	33.0	1.0	2.0	24.0	12.0	5.0	5.0	8.0	10.0	0.0
Crooked Fork	25m blw. 595 Rd. Brdg.	4.0	2.0	1.0	2.0	22.0	17.0	14.0	15.0	22.0	5.0	0.0
Crooked Fork	25m abve. Shotgun Crk	3.1	0.0	3.0	7.0	13.0	13.0	14.0	25.0	15.0	10.0	0.0
Wrm. Spgs. Crk	~150m abve. Mouth	4.0	20.0	4.0	1.0	5.0	8.0	30.0	30.0	2.0	0.0	0.0
Colt Killed Crk	20m abve. Bridge at mouth	1.9	1.0	1.0	1.0	15.0	20.0	32.0	10.0	10.0	10.0	0.0
Lochsa R	1km abve. Castle Crk	4.0	2.0	10.0	30.0	13.0	2.0	3.0	5.0	10.0	25.0	0.0
Lochsa R	1.5km blw. Weir Crk	5.0	17.0	2.0	3.0	3.0	5.0	17.0	35.0	18.0	0.0	0.0
Lochsa R	0.5km abve. Fish Crk	2.0	30.0	35.0	15.0	0.0	0.0	0.0	0.0	0.0	20.0	0.0

Appendix P. Pacific lamprey population trend and surveys in mainstem Clearwater River drainage, ID, 2006.

DATE	TIME	STREAM	RKM/DESCRIPTION	AIR TEMP (°C)	STREAM TEMP (°C)	E.FISHED TIME (min)	LAMPREY CAPTURED	DEPTH AVE. (m)	SHADE (%)
9/21/2006	1430	Clrwtr R.	Gibbs Eddy	14.0	13.0	2.9	0	0.29	0

Appendix Q. Pacific lamprey population trend and survey habitat descriptors, in mainstem Clearwater River drainage, ID, 2006.

PERSONNEL: Hyatt, Hanson			DOMINANT SUBSTRATE PERCENT									
STREAM	RKM/DESCRIPTION	E. FISHED AREA (m^2)	SILT ORG.	FINE SAND	CRSE. SAND	FINE GRVL.	MED. GRVL.	CRSE. GRVL.	CBLE.	SM. BLDR.	LG. BLDR.	OTHER
Clrwtr R.	Gibbs Eddy	5.0	1.0	80.0	19.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Appendix R. Pacific lamprey surveys in mainstem Salmon River drainage, ID, 2006.

DATE	TIME	STREAM	RKM/DESCRIPTION	AIR TEMP (°C)	STREAM TEMP (°C)	E.FISHED TIME (min)	LAMPREY CAPTURED	DEPTH AVE. (m)	SHADE (%)
8/19/2006	1245	Salmon R.	at Indian Crk at Indianola	28.0	18.0	2.0	2	0.38	0.0
8/19/2006	1200	Salmon R.	at Indian Crk at Indianola	28.0	17.5	3.9	13	0.23	0.0
8/19/2006	1032	Salmon R.	0.66km blw. N.F. Salmon	24.0	15.5	4.8	4	0.35	11.8
8/19/2006	0922	Salmon R.	Morgans Bar Cmpgrnd	14.0	15.0	2.6	0	0.24	0.0
8/19/2006	0827	Salmon R.	Bobcat Gulch Sp. Access	11.0	13.0	2.4	0	0.11	0.0
8/19/2006	0856	Salmon R.	10.5km blw. Lower Stanley	6.5	10.5	3.1	0	0.25	13.2
8/17/2006	1018	Salmon R.	Holman Campground	8.0	13.0	3.6	0	0.28	0.0
8/17/2006	1108	Salmon R.	Lower O'Brian Campground	15.0	12.0	6.4	0	0.29	8.8
8/17/2006	1830	Salmon R.	Pennal Gulch Sp. Access	21.0	16.5	2.9	0	0.19	0.0
8/18/2006	0955	Salmon R.	1.0km blw Cow Crk	14.0	13.0	2.5	0	0.15	0.0
8/18/2006	1055	Salmon R.	~200m blw. Camp Crk	19.0	14.0	2.8	0	0.34	0.0
8/3/2006	0750	Salmon R.	2.6km abve. Sawtooth Hatchery	5.5	10.0	3.7	0	0.34	0.0
8/3/2006	0845	Salmon R.	blw. Hell Roaring Crk	9.0	9.5	4.0	0	0.29	2.9
8/3/2006	1054	Salmon R.	~50m abve. Pole Crk Rd. Brdg	17.5	9.0	1.8	0	0.18	25.0
8/3/2006	1002	Salmon R.	0.4km abve B-C County Hwy Brdg	16.0	9.5	1.9	0	0.20	1.5
8/3/2006	1141	Salmon R.	~80m abve. Brdg (Scenic Byway 79)	15.0	10.0	2.5	0	0.31	8.8
8/3/2006	1232	Salmon R.	Campground 2 miles up road 215	21.5	10.0	5.6	0	0.36	19.1
7/21/2006	1100	Salmon R.	Mackey Bar	34.0	21.5	5.6	16	0.34	0.0
10/1/2006	1200	Salmon R.	~150m blw Fall Crk	14.5	12.5	7.9	37	0.28	0.0
10/1/2006	0955	Salmon R.	~250m abve Elkhorn Crk	12.0	12.5	5.8	8	0.19	13.2
9/30/2006	0828	Salmon R.	Hammer Crk boat launch	9.0	12.5	3.1	0	0.23	0.0
9/30/2006	0940	Salmon R.	Lucile boat launch	19.0	12.5	5.4	2	0.31	0.0
10/4/2006	1447	Salmon R.	1.0km abve Whitewater Ranch	22.0	12.0	3.5	8	0.15	0.0
10/5/2006	0900	Bargamin Crk	USFS Campground (Road 468)	12.0	6.0	4.6	0	0.19	39.7
6/28/2006	1345	Salmon R.	Corn Crk boat launch	34.5	17.0	6.6	16	0.40	11.8
10/1/2006	1341	Salmon R.	Vinegar Crk boat launch	16.0	13.0	3.4	0	0.20	0.0
8/20/2006	1203	Salmon R.	0.37km abve Owl Crk	23.0	18.0	7.6	56	0.48	0.0
8/20/2006	1012	Salmon R.	3.3km abve Panther Crk	20.0	18.0	4.8	23	0.26	0.0
8/19/2006	1448	Salmon R.	~350m abve Shoup	29.0	19.0	5.8	17	0.30	2.9
8/20/2006	0931	Panther Crk	2.0km abve mouth	19.0	13.0	2.2	0	0.20	0.0
8/19/2006	1712	Panther Crk	1.3km abve Cobalt	23.0	16.5	3.5	0	0.30	30.9
8/19/2006	1719	Panther Crk	2.6km blw Naipas Crk	27.0	17.0	1.7	0	0.29	32.3
10/15/2006	0937	Salmon R.		11.0	9.0	2.5	1/13*	0.19	0.0

* Lamprey caught outside the measured area

Appendix S. Pacific lamprey survey habitat descriptors in Salmon River drainage, ID, 2006.

PERSONNEL: Hyatt, Licht, Clemenhagen						DOMINANT SUBSTRATE						
		E. FISHED				PERCENT						
STREAM	RKM/DESCRIPTION	AREA (m^2)	SILT ORG.	FINE SAND	CRSE. SAND	FINE GRVL.	MED. GRVL.	CRSE. GRVL.	CBLE.	SM. BLDR.	LG. BLDR.	OTHER
Salmon R.	at Indian Crk at Indianola	2.3	5.0	7.0	13.0	15.0	10.0	35.0	15.0	0.0	0.0	0.0
Salmon R.	at Indian Crk at Indianola	2.0	10.0	60.0	30.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Salmon R.	0.66km blw. N.F. Salmon	5.0	18.0	1.0	1.0	4.0	6.0	12.0	50.0	8.0	0.0	0.0
Salmon R.	Morgans Bar Cmpgrnd	4.0	10.0	63.0	10.0	0.0	0.0	2.0	8.0	7.0	0.0	0.0
Salmon R.	Bobcat Gulch Sp. Access	6.0	40.0	7.0	3.0	10.0	17.0	20.0	3.0	0.0	0.0	0.0
Salmon R.	10.5km blw. Lower Stanley	4.5	45.0	8.0	4.0	21.0	10.0	3.0	4.0	5.0	0.0	0.0
Salmon R.	Holman Campground	6.0	28.0	60.0	1.0	0.0	0.0	1.0	5.0	5.0	0.0	0.0
Salmon R.	Lower O'Brian Campground	15.0	13.0	5.0	5.0	10.0	10.0	25.0	7.0	2.0	23.0	0.0
Salmon R.	Pennal Gulch Sp. Access	8.0	10.0	13.0	65.0	2.0	2.0	1.0	5.0	2.0	0.0	0.0
Salmon R.	1.0km blw Cow Crk	6.0	10.0	65.0	22.0	1.0	0.5	0.5	1.0	0.0	0.0	0.0
Salmon R.	~200m blw. Camp Crk	5.6	4.0	6.0	1.0	0.5	0.5	1.0	12.0	55.0	20.0	0.0
Salmon R.	2.6km abve. Sawtooth Hatch.	6.7	9.0	3.0	7.0	25.0	8.0	3.0	15.0	0.0	30.0	0.0
Salmon R.	blw. Hell Roaring Crk	5.8	5.0	40.0	35.0	3.0	1.0	1.0	1.0	4.0	10.0	0.0
Salmon R.	~50m abve. Pole Crk Rd. Brdg	2.5	50.0	2.0	3.0	10.0	15.0	20.0	0.0	0.0	0.0	0.0
Salmon R.	0.4km abve B-C Cty Hwy Brdg	4.0	85.0	7.0	3.0	1.0	1.0	1.0	2.0	0.0	0.0	0.0
Salmon R.	~80m abve. Brdg (Sc. Bywy 79)	3.0	2.0	10.0	5.0	25.0	25.0	24.0	5.0	4.0	0.0	0.0
Salmon R.	Campground 2 miles up rd. 215	8.0	50.0	0.0	0.0	2.0	2.0	3.0	40.0	3.0	0.0	0.0
Salmon R.	Mackey Bar	3.0	0.0	55.0	20.0	0.0	0.0	0.0	0.0	0.0	25.0	0.0
Salmon R.	~150m blw Fall Crk	6.3	2.0	80.0	10.0	0.0	0.0	0.0	0.0	0.0	8.0	0.0
Salmon R.	~250m abve Elkhorn Crk	4.0	3.0	70.0	11.0	0.0	0.0	1.0	0.0	0.0	15.0	0.0
Salmon R.	Hammer Crk boat launch	5.0	5.0	35.0	15.0	0.0	0.0	0.0	0.0	20.0	25.0	0.0
Salmon R.	Lucile boat launch	8.0	3.0	20.0	5.0	0.0	1.0	4.0	40.0	25.0	2.0	0.0
Salmon R.	1.0km abve Whitewater Ranch	2.0	15.0	65.0	10.0	0.0	0.0	0.0	0.0	7.0	3.0	0.0
Bargamin C.	USFS Campground (Road 468)	8.0	15.0	5.0	15.0	29.0	20.0	10.0	1.0	0.0	0.0	0.0
Salmon R.	Corn Crk boat launch	8.0	4.0	18.0	6.0	4.0	2.0	10.0	6.0	26.0	24.0	0.0
Salmon R.	Vinegar Crk boat launch	8.0	0.0	54.0	5.0	1.0	1.0	1.0	3.0	10.0	25.0	0.0
Salmon R.	0.37km abve Owl Crk	4.0	34.0	45.0	0.0	0.0	0.0	1.0	15.0	5.0	0.0	0.0
Salmon R.	3.3km abve Panther Crk	1.3	50.0	50.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Salmon R.	~350m abve Shoup	3.0	50.0	45.0	5.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Panther Crk	2.0km abve mouth	4.5	15.0	3.0	3.0	47.0	2.0	8.0	5.0	10.0	7.0	0.0
Panther Crk	1.3km abve Cobalt	6.0	23.0	1.0	1.0	0.0	0.0	15.0	50.0	10.0	0.0	0.0
Panther Crk	2.6km blw Naipas Crk	4.0	15.0	10.0	12.0	40.0	20.0	3.0	0.0	0.0	0.0	0.0
Salmon R.		5.3	5.0	35.0	40.0	0.0	0.0	0.0	0.0	0.0	20.0	0.0

Appendix T. Pacific lamprey surveys in M.F. Salmon River watershed, ID, 2006.

DATE	TIME	STREAM	RKM/DESCRIPTION	AIR TEMP (°C)	STREAM TEMP (°C)	E.FISHED TIME (min)	LAMPREY CAPTURED	DEPTH AVE. (m)	SHADE (%)
8/4/2006	1423	Bear Valley Crk	Brdg on Cub Crk Rd.	27.0	15.5	2.7	0	0.29	0.0
8/4/2006	1333	Bear Valley Crk	2.6km blw. Cub Crk Rd	23.0	15.5	3.2	0	0.38	0.0
8/4/2006	1249	Bear Valley Crk	50m blw. Cache Creek	23.5	15.0	3.0	0	0.20	0.0
8/4/2006	1217	Cache Crk	300m abve mouth	23.0	13.5	2.5	0	0.21	4.4
8/3/2006	1541	Cape Horn Crk	1km abve. Highway Brdg	24.0	14.5	6.2	0	0.33	36.8
8/4/2006	1025	M.F. Salmon R.	100m abve. Boat launch	16.5	11.5	3.2	0	0.36	8.8
10/24/2006	1007	M.F. Salmon R.	blw. Loon Crk	-1.0	2.5	9.9	37	0.31	5.9
10/24/2006	1742	M.F. Salmon R.	upper Grouse Camp	9.0	4.0	4.4	6	0.10	0.0
10/25/2006	1425	M.F. Salmon R.	30m abve. Camas Crk	4.0	4.5	4.3	8	0.25	0.0
10/26/2006	0915	M.F. Salmon R.	abve. Aparejo Pt. Rapids	-2.0	3.0	8.8	20/37*	0.28	1.5
10/26/2006	1415	M.F. Salmon R.	Morman Ranch	5.0	4.5	5.1	18	0.19	0.0
10/26/2006	1450	M.F. Salmon R.	Morman Ranch (2)	5.0	4.5	6.4	25	0.43	0.0

* Lamprey caught outside the measured area

Appendix U. Pacific lamprey survey habitat descriptors in M.F. Salmon River watershed, ID, 2006.

PERSONNEL: Hyatt, Licht, Buelow

STREAM	RKM/DESCRIPTION	E. FISHED AREA (m^2)	DOMINANT SUBSTRATE PERCENT SILT ORG.	FINE SAND	CRSE. SAND	FINE GRVL.	MED. GRVL.	CRSE. GRVL.	CBLE.	SM. BLDR.	LG. BLDR.	OTHER
Bear Valley Crk	Brdg on Cub Crk Rd.	6.0	40.0	3.0	7.0	43.0	2.0	3.0	2.0	0.0	0.0	0.0
Bear Valley Crk	2.6km blw. Cub Crk Rd	4.5	50.0	37.0	10.0	3.0	0.0	0.0	0.0	0.0	0.0	0.0
Bear Valley Crk	50m blw. Cache Creek	3.5	35.0	10.0	20.0	10.0	5.0	15.0	5.0	0.0	0.0	0.0
Cache Crk	300m abve mouth	3.0	4.0	12.0	20.0	54.0	2.0	4.0	4.0	0.0	0.0	0.0
Cape Horn Crk	1km abve. Highway Brdg	9.8	5.0	3.0	2.0	4.0	4.0	18.0	60.0	4.0	0.0	0.0
M.F. Salmon R.	100m abve. Boat launch	6.0	2.0	1.0	2.0	7.0	13.0	25.0	25.0	10.0	15.0	0.0
M.F. Salmon R.	blw. Loon Crk	6.0	20.0	1.0	2.0	0.0	0.0	0.0	17.0	40.0	20.0	0.0
M.F. Salmon R.	upper Grouse Camp	1.0	30.0	25.0	45.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
M.F. Salmon R.	30m abve. Camas Crk	4.0	10.0	20.0	20.0	0.0	0.0	0.0	10.0	28.0	12.0	0.0
M.F. Salmon R.	abve. Aparejo Pt. Rapids	7.0	5.0	10.0	25.0	2.0	2.0	5.0	18.0	13.0	20.0	0.0
M.F. Salmon R.	Morman Ranch	5.0	25.0	0.0	5.0	70.0	0.0	0.0	0.0	0.0	0.0	0.0
M.F. Salmon R.	Morman Ranch (2)	4.0	25.0	0.0	0.0	45.0	7.0	3.0	15.0	5.0	0.0	0.0

Appendix V. Pacific lamprey surveys in E.F. Salmon River, Pahsimeroi River, and Lemhi River watersheds, ID, 2006.

DATE	TIME	STREAM	RKM/DESCRIPTION	AIR TEMP (°C)	STREAM TEMP (°C)	E.FISHED TIME (min)	LAMPREY CAPTURED	DEPTH AVE. (m)	SHADE (%)
8/17/2006	1306	E.F. Salmon R.	0.75km abve. mouth	20.0	13.0	2.4	0	0.20	86.7
8/17/2006	1451	Deer Crk	Germania Trail Head	19.5	13.0	2.4	0	0.34	60.3
8/17/2006	1618	Herd Crk	2.5km abve. mouth	23.5	15.5	3.3	0	0.30	13.2
8/17/2006	1708	E.F. Salmon R.	Herd Crk Rd. bridge	22.0	16.0	2.1	0	0.14	1.5
8/18/2006	0846	Pahsimeroi R.	Bridge just above mouth	8.0	10.5	3.6	0	0.24	92.6
8/18/2006	1453	Lemhi R.	Sp. Access above Tendoy	25.0	14.5	0.9	0	0.16	51.5
8/18/2006	1353	Lemhi R.	1.0km blw. Muddy Crk	18.0	14.0	2.5	0	0.36	51.5
8/18/2006	1157	Lemhi R.	0.66km abve mouth	17.0	16.5	2.3	0	0.14	22.1

Appendix W. Pacific lamprey surveys in E.F. Salmon River, Pahsimeroi River, and Lemhi River watersheds, ID, 2006.

PERSONNEL: Hyatt, Licht			DOMINANT SUBSTRATE PERCENT									
STREAM	RKM/DESCRIPTION	E. FISHED AREA (m^2)	SILT ORG.	FINE SAND	CRSE. SAND	FINE GRVL.	MED. GRVL.	CRSE. GRVL.	CBLE.	SM. BLDR.	LG. BLDR.	OTHER
E.F. Salmon R.	0.75km abve. mouth	5.3	10.0	58.0	10.0	10.0	2.0	2.0	3.0	3.0	2.0	0.0
Deer Crk	Germania Trail Head	4.0	50.0	30.0	11.0	0.0	0.0	1.0	1.0	0.0	7.0	0.0
Herd Crk	2.5km abve. mouth	4.0	10.0	48.0	20.0	2.0	2.0	10.0	1.0	0.0	7.0	0.0
E.F. Salmon R.	Herd Crk Rd. bridge	4.5	47.0	37.0	10.0	1.0	1.0	1.0	3.0	0.0	0.0	0.0
Pahsimeroi R.	Bridge just above mouth	10.0	3.0	62.0	21.0	1.0	2.0	3.0	4.0	4.0	0.0	0.0
Lemhi R.	Sp. Access above Tendoy	1.4	10.0	10.0	15.0	15.0	25.0	20.0	5.0	0.0	0.0	0.0
Lemhi R.	1.0km blw. Muddy Crk	4.0	83.0	1.0	1.0	1.0	2.0	4.0	3.0	0.0	5.0	0.0
Lemhi R.	0.66km abve mouth	5.0	10.0	1.0	1.0	2.0	2.0	12.0	65.0	7.0	0.0	0.0

Appendix X. Waters surveyed in the Clearwater and Salmon River drainages and presence or absence of Pacific lamprey.

Clearwater River Drainage		Salmon River Drainage	
System	Lamprey	System	Lamprey
Clearwater River	Y	East Fork Salmon River	N
		Boulder Creek	N
Lochsa River	Y	Deer Creek	N
Boulder Creek	N	Germania Creek	N
Brushy Fork	N	Herd Creek	N
Colt Killed Creek	N	West Pass Creek	N
Crooked Fork of the Lochsa River	N		
Fish Creek	N	Lemhi River	N
Pete King Creek	N	Hayden Creek	N
Post Office Creek	N	Texas Creek	N
Shotgun Creek	N		
Squaw Creek	N	Little Salmon River	N
Warm Springs Creek	N	Big Creek	N
Weir Creek	N	Boulder Creek	N
		Goose Creek	N
Middle Fork Clearwater River	Y	Hard Creek	N
Clear Creek	N	Hazard Creek	N
Eldorado Creek	N	Mud Creek	N
Lawyers Creek	N	Rapid River	N
Lolo Creek	N		
Musselshell Creek	N	Middle Fork Salmon River	Y
Orofino Creek	N	Bear Skin Creek	N
		Bear Valley Creek	N
North Fork Clearwater River	N	Big Creek	N
Beaver Creek	N	Cache Creek	N
Breakfast Creek	N	Camas Creek	N
Cayuse Creek	N	Cape Horn Creek	N
Dworshak Reservoir	N	Elk Creek	N
Fish Lake Creek	N	Marsh Creek	N
Kelly Creek	N	North Fork Elk Creek	N
Little North Fork Clearwater River	N	Pistol Creek	N
Long Creek	N		
Moose Creek	N	North Fork Salmon River	N
Osier Creek	N		
Weitas Creek	N	Pahsimeroi River	N
		Big Creek	N
Potlatch River	N		
Big Bear Creek	N	Salmon River	Y
East Fork Potlatch River	N	Bargamin Creek	N
		Basin Creek	N
Red River	Y	Challis Creek	N
Red Horse Creek	N	Crooked Creek	N
South Fork Red River	N	Eagle Creek	N
		French Creek	N
Selway River	Y	Little Whitebird Creek	N
Bear Creek	N	Mallard Creek	N
Deep Creek	N	Panther Creek	N
Ditch Creek	N	Pole Creek	N
Elk Creek	N	Slate Creek	N
Gedney Creek	N	Smiley Creek	N

Y = lamprey were collected; N = lamprey were not collected

Appendix X. Continued.

Clearwater River Drainage		Salmon River Drainage	
System	Lamprey	System	Lamprey
Selway River continued		Salmon River continued	
Indian Creek	N	South Fork Whitebird Creek	N
Little Clearwater River	N	Texas Creek	N
Meadow Creek	N	Valley Creek	N
White Cap Creek	N	Whitebird Creek	N
Snake River	Y	South Fork Salmon River	N
		Blackmare Creek	N
South Fork Clearwater River	Y	Buckhorn Creek	N
American River	N	Cabin Creek	N
Crooked River	N	Dollar Creek	N
John's Creek	N	East Fork of South Fork Salmon River	N
Leggett Creek	N	Johnson Creek	N
Little Elk Creek	N	Lake Creek	N
Meadow Creek	N	Secesh River	N
Mill Creek	N	Summit Creek	N
Newsome Creek	N	Trail Creek	N
Ten Mile Creek	N	Warm Lake Creek	N
West Fork American River	N	Warren Creek	N
		Yankee Fork Salmon River	N
		West Fork of Yankee Fork Salmon River	N

Y = lamprey were collected; N = lamprey were not collected