Western Pond Turtle Head-starting and Reintroduction

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Annual Report
BPA Project #2001-027-00

Western Pond Turtle Head-Starting and Reintroduction
Oct. 2003 thru Sept. 2004

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Western Pond Turtle Head-Starting and Reintroduction, Oct. 2003 thru Sept. 2004

Progress Report

Abstract: This report covers the results of the western pond turtle head-starting and reintroduction project for the period of October 2003 – September 2004. Wild hatchling western pond turtles from the Columbia River Gorge were reared at the Woodland Park and Oregon Zoos in 2003 and 2004 as part of the recovery effort for this Washington State endangered species. The objective of the program is to reduce losses to introduced predators like bullfrogs and largemouth bass by raising the hatchlings to a size where they are too large to be eaten by most of these predators. Sixty-nine turtles were over-wintered at the Woodland Park Zoo and 69 at the Oregon Zoo. Of these, 136 head-started juvenile turtles were released at three sites in the Columbia Gorge in 2004. Two were held back to attain more growth in captivity. Thirty-four were released at the Klickitat ponds, 19 at the Klickitat lake, 21 at the Skamania site, and 62 at Pierce National Wildlife Refuge (NWR). This brought the total number of head-start turtles released since 1991 to 246 for the Klickitat ponds, 114 for the Klickitat lake, 167 for the Skamania pond complex, and 250 at Pierce NWR. In 2004, 32 females from the two Columbia Gorge populations were equipped with transmitters and monitored for nesting activity. Twenty-one of the females nested and produced 85 hatchlings. The hatchlings were collected in September and October and transported to the Woodland Park and Oregon zoos for rearing in the head-start program. Data collection for a four-year telemetry study of survival and habitat use by juvenile western pond turtles at Pierce NWR concluded in 2004. Radio transmitters on study animals were replaced as needed until all replacements were in service; afterward, the turtles were monitored until their transmitters failed. The corps of study turtles ranged from 39 in August 2003 to 2 turtles at the end of August 2004. These turtles showed the same seasonal pattern of movements between summer water and upland winter habitats observed in previous years. During the 2004 field season trapping effort, 345 western pond turtles were captured in the Columbia Gorge, including 297 previously head-started turtles. These recaptures, together with confirmed nesting by head-start females and visual resightings, indicate the program is succeeding in boosting juvenile recruitment to increase the populations. Records were also collected on 224 individual painted turtles captured in 2004 during trapping efforts at Pierce NWR, to gather baseline information on this native population. Bonneville Power Administration (BPA) funded approximately 60% of program activities in the Columbia River Gorge from October 2003 through September 2004.

Acknowledgments

This project is a federal/state/private cooperative effort that has been in progress since the late 1980s. Activities conducted during this report period were primarily funded by BPA in cooperation with Washington Department of Fish and Wildlife (WDFW), the U.S. Fish and Wildlife Service (USFWS), the Woodland Park Zoo and The Oregon Zoo. Sarah Branum provided oversight of this project for the Bonneville Power Administration. Additional funding was provided by the Aquatic Lands Enhancement Account for support of volunteers to assist with field activities in 2004. Kate Slavens, WDFW, and Frank Slavens, Woodland Park Zoological Society, coordinated and led the trapping and monitoring of female turtles to obtain hatchlings for head-starting. Dana Payne directed the head-starting of turtles at the Woodland Park Zoo. David Shepherdson and Blair Csuti facilitated the head-starting of hatchling turtles at The Oregon Zoo in Portland. Joe Engler, USFWS, facilitated the release and monitoring of juvenile pond turtles at the Pierce NWR in the Columbia Gorge. Steven Clark, Kathleen Perillo, and Susan Van Leuven, WDFW, and volunteer David Swanson monitored released juvenile turtles at the Pierce NWR.

Eric Holman, Mary McCallum, and Jason Thompson, WDFW, conducted trapping at the Skamania County site, and were assisted by other volunteers in monitoring female pond turtles there. Susan Van Leuven was assisted in trapping turtles at Pierce NWR by Eric Holman, Jeff Azerrad, Kelly Harlan, Lisa Renan, and Bill Weiler, of WDFW; Sarah Branum, of Bonneville Power Administration; and volunteers Michelle Westerman, Sharon Ralston, Rob Kraai, Cory Whitmore, Hannah Lucas, and Jeff Paine. David Anderson participated in all aspects of the work in the Columbia River Gorge. A number of volunteers, including Jerry Novak, Walter English, David Swanson, Mike Teller, Kevin Hawkins, Sarah Lee, Julie Tench, and others from The Oregon Zoo, assisted in the monitoring of female pond turtles at the Klickitat County and Skamania County sites. The labors of all of these individuals were and are essential to the success of the 2004 field season for western pond turtle recovery in Washington.

Introduction

The western pond turtle (*Clemmys marmorata*) has been classified since 1993 as an endangered species in Washington and is considered a Species of Concern by the U.S. Fish and Wildlife Service. The western pond turtle is declining throughout its range and is highly vulnerable to extirpation in Washington. The species was once well distributed in southern Puget Sound lowland lakes and ponds and in the Columbia River Gorge. The western pond turtle has been essentially extirpated from Puget Sound and, within the Washington portion of the Columbia River Gorge, only two small, isolated populations remain in Skamania and Klickitat counties.

The Washington Department of Fish and Wildlife (WDFW) wrote a recovery plan for the species in Washington in 1999 (Hays et. al 1999). The plan calls for establishing a total of 7 populations of more than 200 turtles each – 4 in the Columbia Gorge and 3 in Puget Sound. Achieving this recovery objective will require an ongoing program of head-starting hatchling turtles, captive breeding, and reintroduction until population numbers are increased to ensure the species' survival in Washington. Population size must be sufficient to overcome the effects of juvenile mortality by introduced predators such as bullfrogs and warmwater fish, and such sources of juvenile mortality must be reduced or eliminated. The total number of western pond turtles in Washington is estimated at between 950 and 1000 individuals, many of them young turtles that went through the head-start program at the Woodland Park Zoo. The WDFW and the Woodland Park Zoo have been working cooperatively on this recovery effort since 1990, and were joined in 2000 by The Oregon Zoo.

WDFW manages approximately 200 acres of habitat in Klickitat County containing the most important western pond turtle population remaining in the state. This land is currently being maintained as part of the Klickitat Wildlife Area. The U.S. Forest Service (USFS) currently owns approximately 200 acres of western pond turtle habitat at the Skamania County site. In 2004, WDFW and USFS developed a Memorandum of Understanding (MOU) for the management of this species on USFS lands in Skamania County. The agreement outlines specific agencies' responsibilities for the recovery of the western pond turtle.

Project Area

The project area consists of three sites in the Columbia River Gorge in Klickitat and Skamania counties. The largest naturally occurring population of western pond turtles is in Klickitat County. The Klickitat population consists of a lake group and a pond complex group. Although the lake and pond complex are connected geographically, turtles have only rarely been documented moving between them. The WDFW owns and manages these critical wetlands. In 1994, the population at this site was estimated at 117

individuals. Since then, 335 head-started juvenile turtles have been released at the Klickitat County site, substantially boosting the population there.

The second site, in Skamania County, contains the only other naturally occurring population in the Columbia River Gorge. This site is a mosaic of private and public land ownership. The USFS manages all public lands associated with this site, in cooperation with WDFW. The MOU between the USFS and WDFW defines goals and objectives as well as responsibilities for the future management of western pond turtles on federal lands within the Columbia River Gorge. The western pond turtle population at this location was estimated at 39 individuals in 1994. At total of 164 head-started turtles have been released at the Skamania County site since 1994.

The third site in the project area, in western Skamania County, is the Pierce (NWR). This area is the first reintroduction site for western pond turtles in the Columbia River Gorge. The goal is to establish the third of four populations needed to recover the pond turtle in the Columbia River Gorge. The site is managed by the USFWS. A total of 250 turtles have been released at Pierce National Wildlife Refuge since the summer of 2000.

Work Description

The goal of this project is to establish four self-sustaining populations of western pond turtles in the Columbia River Gorge recovery zone. Bonneville Power Administration (BPA) funding currently provides primary support for this long-term effort. There are five objectives of the BPA project. The work conducted and results for each objective for the 2004 field season are described below.

Objective 1: Inventory and Mark-Recapture Western Pond Turtles in the Columbia River Gorge.

Methods: A mark-recapture program was conducted to estimate current population size at the Klickitat and Skamania county sites. A similar program was also undertaken at Pierce NWR; however estimated population size for Pierce NWR is based on survival rates of juvenile western pond turtles monitored in an ongoing telemetry study. WDFW captured a representative number of western pond turtles in selected ponds and lakes at each site using two types of live traps (hoop and basking). Trapping was conducted continuously from 11 May through 11 June at the Skamania county site, and 3 April through 20 May at the Klickitat County site. Traps were checked daily. At Pierce NWR, traps were placed in the ponds and checked daily for a three-week period in May, then removed. Traps were again placed in service for a two-week period in June. Turtles were also captured opportunistically by dipnet and by hand whenever possible, during the trapping period. Unfavorable weather apparently suppressed trapping success in May; the June effort yielded more typical results. At all sites, individual animals were identified by previously marked notches on the carapace. Identities of head-started juvenile western pond turtles captured at Pierce NWR in 2004 were verified by checking the implanted microchip numbers, when possible. Unmarked animals were given a number by filing notches in the carapace for future identification.

In fulfillment of an agreement with USFWS for use of Pierce NWR as a western pond turtle reintroduction site and to gain information on potential issues relating to interspecific competition between western pond turtles and western painted turtles, a mark-recapture program for western painted turtles was integrated with the pond turtle trapping activity. Painted turtles occur naturally at this site, and while the two species are expected to coexist in relative harmony, studies are being conducted to monitor

the painted turtle population and use of habitat, so that changes resulting from introduction of pond turtles may be detected. The same standard set of data was collected for both species during trapping, and turtles were marked in a similar fashion except that the painted turtles were notched using a different numbering system. Both species were captured concurrently using the same techniques and equipment.

Results: A total of 345 western pond turtles were captured in 2004 (Table 1). Head-start turtles comprised 82% of the total number of turtles captured at the two wild population sites in Klickitat and Skamania counties, revealing the importance of the program in adding recruits to the extant populations. At Pierce NWR, all western pond turtles present are the result of head-start reintroductions, and thus equal 100% of the captures.

Table 1. Columbia River Gorge western pond turtle trapping results for 2004.

Location	# turtles	# head starts	# adult females
Klickitat County	203	166	22
Skamania County	59	48	5
Pierce NWR	83	83	0
Total	345	297	27

At the Skamania County site, a bear raided turtle traps in one of the ponds. It is unknown whether any turtles were lost, however the traps were removed from that pond as a precaution. Traps were also dragged from a pond by a bear in 2003. Those traps were baited with canned fish. The traps damaged in 2004 did not contain bait, except possibly turtles.

At Pierce NWR, 224 individual western painted turtles were captured along with the pond turtles in 2004. Based on May and June 2004 capture results, population estimates of 229 (206 – 266 at 95% Confidence Interval) and 213 (184 – 259, 95% CI) animals were generated using computer program Capture. Trapping data for each month was handled as a separate set, yielding two different results. Evidence suggests that the process used for estimating population size produces figures significantly lower than expected, based on other facts and observations, and is being reviewed.

WDFW is developing an improved method to generate western pond turtle population estimates at the three Columbia River Gorge sites. The objective is to produce figures that are more up-to-date and more closely align with field observations, offering a better basis for management decisions. Interim population estimates (Table 2) are based on observed survival rates of head-start juvenile western pond turtles at Pierce NWR. Turtles from the combined 2000 and 2001 cohorts monitored by telemetry from August 2000 through November 2001 had an annual survival rate of .95, with a 95% confidence interval of .86 to 1.00. Figures in the table were derived by extending that survival rate over more years and to the other sites, using known numbers of head-start turtles released at the sites, and assuming 1994 population estimates are correct. The estimates do not include the turtles released in summer 2004 because they have been onsite for less than a year, but at least 95% of those newly released animals are expected to be present in fall 2004.

Table 2. Population estimates for three western pond turtle populations in the Columbia River Gorge.

Location	1994 Population Estimate	2004 Population Estimate Based on 95% Annual Survival Rate*	Released Summer 2004
Klickitat Site	117	317	53
Skamania Site	39	137	21
Pierce NWR	0	167	62

*Early summer, prior to release of new head-start turtles.

Objective 2: Maintain Head-start Program.

Methods: The program of head-starting wild hatchlings, and evaluating their survival and growth using mark-recapture, was maintained. Adult female western pond turtles were captured at the Klickitat and Skamania sites during April, May, and June using hoop traps, basking platform traps, and submerged open-top net traps designed by WDFW staff. Adult females were also captured while upland, near nesting sites. All captured pond turtles were identified, weighed, and measured. Adult females were equipped with Advanced Telemetry System model 7PN radio transmitters, which have an expected life of 344 days and weigh 14 g. Transmitters were attached to the carapace using epoxy adhesive. The females were monitored until egg laying occurred. Nest sites were identified and protected from predation with wire mesh exclosures. After the summer incubation period, hatchlings were removed from nests in September and early October. These turtles were taken to Woodland Park Zoo and the Oregon Zoo for rearing over the winter. Following the period in captivity (October to July), juveniles were released into the Klickitat ponds and lake, the Skamania ponds, and ponds at the Pierce NWR for population augmentation.

Results: A total of 32 female western pond turtles were monitored for nesting during the 2004 breeding season (Table 3). Weights of the captured female turtles ranged from 473 to 819 g. Mean weights were 634 g at the Klickitat sites and 667 g at the Skamania ponds. Carapace lengths ranged from 145 to 178 mm (mean = 157 mm at Klickitat sites; 164 mm at the Skamania ponds).

The females were monitored for nesting activity from 26 May – 15 July 2004, except for 7 turtles whose transmitters failed before the end of the season. One additional transmitter failed but was replaced in time to locate a nest for that turtle. Turtles began laying eggs on 26 May and continued until 1 July. Of the monitored females, 21 were documented to nest (13 at the Klickitat ponds, 4 at the Klickitat lake, and 4 at the Skamania site). The remains of one female that had been preyed on by a bear were found by locating the still-active transmitter. No adult western pond turtles are present at Pierce NWR, therefore no females were monitored for nesting there. The first turtles released at Pierce NWR are expected to reach maturity in 2009.

The 21 nests were protected with wire exclosures and checked in September for hatched eggs. Predicted hatching dates were 100 days from the date of laying, and hatching occurred from 3 September to 6 October 2004. The 21 nests produced 85 hatchlings out of 125 eggs laid (68% hatching success) (Table 3). Average clutch size for the 21 nests was 5.95 eggs per nest; average number of hatchlings per nest was 4.05.

Table 3. Western pond turtle nesting results in the Columbia Gorge, Washington, 2004.

Location	# Females Monitored	Capture Dates	Date Laid	# Nests	# Eggs	# Fertile	# Hatched
Klickitat County ponds	22	4 April – 29 June	26 May – 1 July	13	78	68	56
Klickitat County lake	5	7 April – 15 June	13 – 20 June	4	28	26	25
Skamania County ponds	5	1 – 18 June	16 June – 1 July	4	19	11	4
Total	32*			21	125	105	85

*Eight transmitters failed during the nesting season. One dead transmitter was replaced resulting in location of a nest for that turtle. The other 7 turtles were lost to the monitoring effort.

The 85 hatchlings (56 from the Klickitat ponds, 25 from the Klickitat lake, and 4 from the Skamania ponds) were collected from the nests and transported from the field to the head-start program at Woodland Park Zoo in Seattle and the Oregon Zoo in Portland. Three hatchlings from the Klickitat ponds were also captured in traps in spring 2004 and taken to Woodland Park Zoo for headstarting

Hatchlings collected in 2003 were raised in captivity for release in 2004. Sixty-nine turtles were over-wintered at the Woodland Park Zoo and 69 at the Oregon Zoo. In summer of 2004, 136 head-start turtles were released in the Columbia Gorge: 34 at the Klickitat ponds, 19 at the Klickitat lake, 21 at the Skamania site, and 62 at Pierce NWR. Two young turtles collected in 2003 were held over for an extra year to attain more growth before release. This brought the total number of head-start turtles released since 1991 to 246 for the Klickitat ponds, 114 for the Klickitat lake, 167 for the Skamania pond complex, and 250 at Pierce NWR.

One unmarked two-year-old western pond turtle that had not been head-started was captured at the Klickitat ponds. It was measured, marked, and returned to the pond. Its size was equivalent to that of a one-year-old head-start turtle ready for release.

A database is being maintained on all western pond turtles that have been handled and marked in Washington, with an individual specimen page noting all observations and capture information for each turtle. There are now a total of 1275 individual specimen pages for Washington turtles, including wild caught, captive-bred, head-started, and opportunistically obtained captive breeding stock. These records cover the years from 1985-2004.

Objective 3: Establish New Populations of Turtles.

Methods: Some of the juvenile western pond turtles reared in the head-start program were released at Pierce NWR to establish a new population of turtles in the Columbia Gorge. A representative subset of these turtles was tracked by radio telemetry to determine survival and habitat use.

A total of 250 turtles were released during the first four years of the reintroduction program (40 in 2000; 38 in 2001; 59 in 2002; 51 in 2003; and 62 in 2004). All years, turtles were released at two of the four main bodies of water on the refuge, Pierce Lake and the Beaver Pond. In years 2000 through 2003, turtles

were also released in the South Slough, and in years 2001 through 2004, turtles were released at a new pond, Domestic Spring (also called North Slough).

Some of the juvenile turtles released in 2000, 2001, 2002, and 2003 were fitted with 2.8 g BS-2GT transmitters (Holohil Limited, Corp., Ontario, Canada) measuring 18 mm across, with a 20 cm flexible whip antenna and encased in a waterproof resin. There were two types of transmitters in use in late 2003 and in 2004. One type was temperature sensitive; the number of pulses per second decreased with lowered temperatures; expected battery life was nine months at 30ºC. The non-temperature sensitive transmitters had a battery life of seven months. All transmitters were painted with enamel model paint to aid in remote identification. The transmitters were affixed to the carapace using Stikki-Wax. These turtles were monitored twice weekly during late summer and fall 2003 when turtles were active, and once weekly in winter when the turtles were dormant. Monitoring was reduced to once every two weeks in spring 2004.

Trapping was conducted at Pierce NWR in May and June 2004. Turtles captured during the trapping effort were weighed and measured to obtain information on growth rates of released juveniles.

In July – August 2004, vegetation characteristics were described for 140 randomly assigned plots at Pierce NWR. All were located within a specified distance from water, designed to encompass the habitats available to western pond turtles moving upland to winter hibernacula. Characteristics of the randomly selected plots will be compared to characteristics of overwintering sites selected by turtles, to determine whether the turtles are scattering in a random fashion, or choosing specific habitats as observation suggests.

Results: Radio tracking of instrumented turtles has yielded detailed information on habitat use and survival of western pond turtles at Pierce NWR. The maximum number of animals monitored concurrently during the telemetry study was 40, after the 2003 cohort was released in July. Attrition in the size of the study group occurred as transmitters failed. The 2003 cohort experienced an especially high rate of premature transmitter failure. By December 2003, 25 turtles were being tracked. This is about equal to the number at the end of 2002 (26). Transmitters nearing the end of expected battery life were replaced until all available transmitters were in service. Then, as batteries failed the number of transmitters dwindled. At the end of August 2004 there were only 2 active transmitters.

Turtles in the telemetry study continued to exhibit a high survival rate. There were 3 documented mortalities within the study group between July 2003 and 30 August 2004. On 29 August 2003, a turtle from the 2001 release was found dead near its upland form. Its condition suggested that it was probably taken by a predator; however it may have died in its form and later been scavenged. Another turtle from the 2001 cohort was found dead on 15 November 2003, apparently killed by a predator while moving to its upland wintering spot. On 12 July 2004, a turtle from the 2002 release was found dead in Pierce Lake. The cause of death is unknown. This was the first instance where a turtle was found dead in mid-summer showing no signs of trauma. One other mortality was noted when a 2003 turtle with an expired transmitter was found crushed on a road near one of the ponds on 9 April 2004. While this animal was not being monitored at the time, its loss demonstrates the potential for such accidents, however preventable.

The 2003 cohort of western pond turtles released at Pierce NWR included 16 turtles equipped with transmitters. Six were released into Pierce Lake, 5 into Domestic Spring Pond, 3 into Beaver Pond and 2 into South Slough. Two of the turtles left the water and went upland after only 5 and 9 days respectively. Eleven of the 16 were upland by the end of August. These exit dates are early compared to those for the older pond turtles monitored during the same time interval at Pierce NWR. All the transmitter-equipped turtles from the 2003 cohort wintered upland.

Most of the study turtles left the water in September and October. The last turtle to seek an upland hibernaculum exited the water in December. For the third year, several turtles overwintered in Beaver Pond and Domestic Spring Pond (the deeper ponds). No turtles stayed in Pierce Lake or South Slough, the two shallowest bodies of water. Pierce Lake was drained in early September 2003 to facilitate seining of nonnative fish and tadpoles. This may have influenced pond turtle occupancy of the lake; at least one painted turtle was observed heading overland after leaving the lake the day of the seining effort.

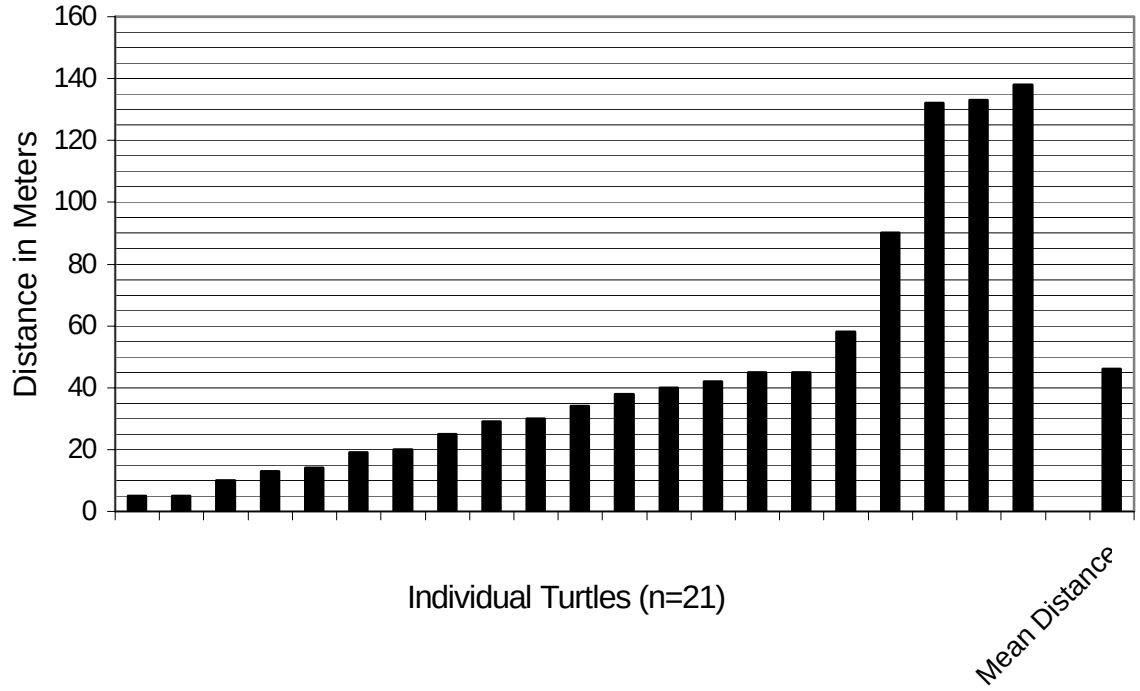

Figure 1. Distance between summer pond and winter hibernacula of juvenile western pond turtles at Pierce NWR during winter 2003 – 2004.

Several turtles established winter hibernacula considerable distances from their summer ponds (Fig. 1). These hibernacula were frequently near a streambed, which in spring offered the nearest point of re-entry to water when the turtles emerged from dormancy.

Twenty-one of the 25 monitored turtles spent at least part of winter 2003-2004 upland. A few of the study turtles made moves in midwinter. Two turtles from Pierce Lake moved from upland locations back into the water. Two other turtles' winter forms were flooded periodically in December 2003 and January 2004. When flooded, the turtles moved a few centimeters each week but when waters receded they created new forms and became immobile. During winter telemetry work, turtle locations were marked in a way that made small moves detectable.

Aquatic turtles moved often within a limited area of about 20 sq m, and within 5 m of the shoreline. Four turtles spent the entire winter in water. One turtle moved from an upland site to a pond on 22 January and remained there until the onset of the active season. Another turtle moved from its form to a shallow wetland adjacent to Pierce Lake in January; three weeks later this animal moved 10 m back to an upland spot for the remainder of the winter.

Table 4. Habitats used by western pond turtles at Pierce National Wildlife Refuge for wintering sites in 2003 – 2004

Number of Turtles (n = 25)	Vegetation Type	Comments
838, 553, 756, 567, 825, 827, 573, 591 8 = 32%	Cottonwood and ash, often with understory of rose, snowberry, and Himalayan blackberry.	567 established a form upland, then moved to a winter pond.
723, 604, 666, 608 (567) 4 = 16%	Water	567 moved to a winter pond from an upland site.
566, 641, 858 3 = 12%	Oak and ash with understory of snowberry and rose	
837, 737, 728 3 = 12%	Ash with understory of reed canary grass	737 moved a few meters into a winter pond for 3 weeks in January then back to an upland site for February.
688, 729, 836 3 = 12%	Hardwood overstory *not* dominated by ash, oak, or cottonwood	729 was under an exclusively hawthorn overstory
759, 814 2 = 8%	Himalayan blackberry	
730 1 = 4%	Ash with understory of Himalayan blackberry	
855 1 = 4%	Reed canary grass	855 was 1 of only 2 turtles to overwinter without tree or shrub cover during the 4 year study

Turtles overwintering in upland areas in 2003-2004 dispersed in a pattern similar to that of earlier years. Turtles that wintered upland typically left the water and moved into a woodland area via a draw. The dominant tree species in woodlands used by the monitored turtles are cottonwood (*Populus trichocarpa*), ash (*Fraxinus latifolia*), and oak (*Quercus garryana*). The turtles usually selected areas that had a shrubby understory composed of snowberry (*Symphoricarpos albus*), rose (*Rosa* spp.), and/or Himalayan blackberry (*Rubus discolor*) (Table 4). They burrowed under 5-10 cm of leaf litter and duff to establish hibernacula. Upland turtles frequently moved from 1 to 20 m or more during September through November. Most turtles were stationary in January and February.

In March – May 2004, turtles re-entered the water (Fig. 2). Between January and May the number of monitored turtles dropped from 24 to 18. Most of the movements occurred in spring, as in previous years, when juvenile turtles return to their summer ponds. The route may be direct (often cross-country) or indirect (following a series of watercourses). Most of the turtles returned to one body of water and remained there for the active season. One turtle spent most of the summer in Hardy Creek, while the others summered in ponds or other backwater areas. The only significant movement over land during summer was when the turtle in Hardy Creek moved to Domestic Spring Pond in August.

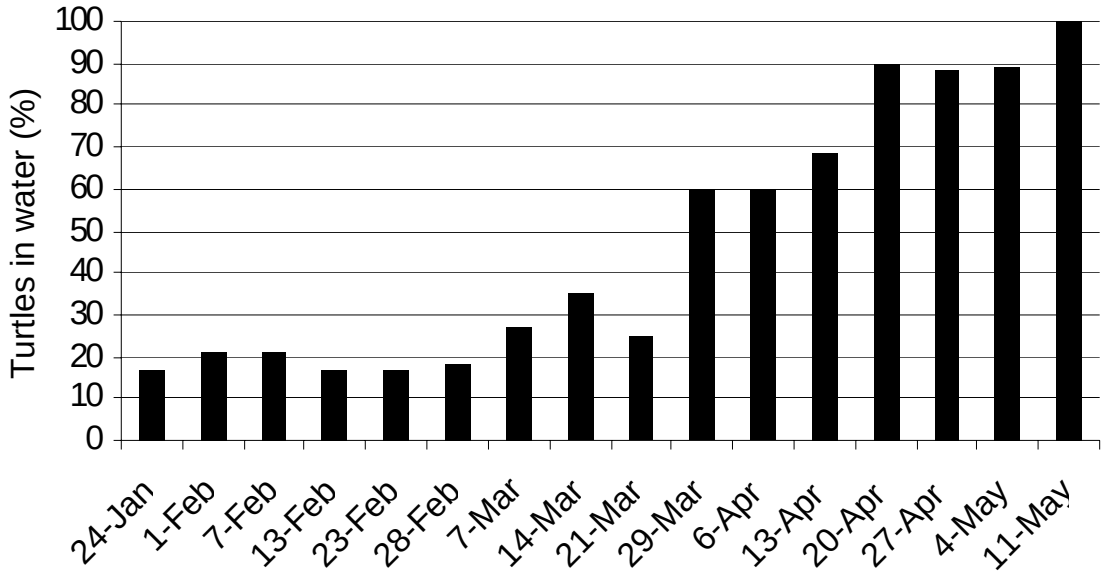

Figure 2. Percent of monitored western pond turtles in water January through May 2004, at Pierce National Wildlife Refuge, Washington.

Turtle observations during summer 2004 were affected by the steady loss in contact with study turtles as transmitters failed at the end of battery life. However, turtle activity during this season was similar to that recorded for summers 2001-2003. Juvenile turtles spent almost all their time in water, and mostly in a single body of water.

Characteristics of the individual bodies of water at Pierce NWR appear to influence turtle utilization of these habitats. Domestic Spring Pond is one of two major perennial bodies of water on the refuge, and is probably the deepest pond. Each year, some of the study turtles have wintered in this pond. Turtles also move both north and south out of the pond to upland hibernacula. Some of the southbound turtles overwinter on the bank of Hardy Creek. The study turtles returned to Domestic Spring Pond by an upland route rather than following Hardy Creek downstream the short distance to its confluence with the outlet of Domestic Spring Pond. The South Slough is a blind channel that joins Hardy Creek, near its confluence with the Columbia River. Water levels vary from about 2 m to completely dry. Although water is limited to small pools by September, and all of the turtles generally go upland earlier than at other sites on the refuge, the turtles usually overwinter on the banks of the slough or on the flats nearby. These turtles return directly to the slough in spring. Pierce Lake is the largest impoundment on the refuge, and is associated with numerous small, seasonal wetlands. The lake is expansive and supports a large number of turtles. However its water levels fluctuate, and by September it is reduced to a small stream channel. All of the study turtles occupying Pierce Lake have wintered upland. They frequently exit and return to the lake via nearby streams or ephemeral pools. Some of the turtles spend the dormant season a short distance upland and return directly to the lake. The Beaver Pond is the other perennial pond at the refuge. Each year some of the study animals over winter in this pond. Turtles also exit this pond in all directions. They often establish hibernacula on an upland site between Beaver Pond and Pierce Lake. Several have wintered on or near the golf course adjacent to the refuge, utilizing a small stream, channels through a marshy area, or an upland route in their movements. Turtles monitored in the study sometimes moved

between Pierce Lake and Beaver Pond, especially in spring and fall. Turtles also moved among the other bodies of water, but these moves were unusual.

In May – June 2004, 83 pond turtles were captured and measured at the Pierce NWR, and their weights compared to records from previous years (Table 5). A review of measurements taken on turtles captured repeatedly in the telemetry study and during trapping revealed that body weights vary by up to 12% depending on how long the animals have been active following winter dormancy, and how long they were in upland hibernacula. Therefore, the only records used in evaluating growth of head-start turtles at Pierce were those taken in May through July, after nearly all animals had resumed warm-season activities.

Turtles released in 2000 gained an average of 34.3 g/yr in approximately 4 years, for a mean weight gain of 154% since release. Turtles released in 2001 gained an average of 100% in approximately 3 years, and the mean weight gain among the 2002 cohort was 45% over the 2 years since release. Turtles released in 2003 gained an average of 6% in weight, with 6 of the turtles experiencing a loss.

Table 5. Mean weight gain for western pond turtles released at Pierce National Wildlife Refuge, Washington, and recaptured in 2004*.

Cohort	Number of Animals	Mean Wt. at Release	Mean Wt. Gain	Range in Wt. Gain
2000	22	89.0 g	34.3 g/yr	19 to 49 g/yr
2001	19	98.9 g	33.1 g/yr	12 to 53 g/yr
2002	20	82.2 g	18.4 g/yr	6 to 40 g/yr
2003	19	95.9 g	5.6 g/yr	- 8 to 17 g/yr

*Three of the 83 captured were not included due to incomplete data.

Recognizing stagnant growth during the first year following release and its effect on mean weight gain for subsequent years, a separate set of figures were compiled for growth after the first anniversary since release (Table 6). These figures suggest that annual growth rate differences are less pronounced when the first year following release is removed from consideration. These results should be considered preliminary since sample sizes are small, especially relative to the wide range in values.

Table 6. Mean weight gain for western pond turtles excluding the first year following release at Pierce National Wildlife Refuge, Washington*.

Cohort	Number of Animals	Mean Wt. Gain	Range in Wt. Gain
2000	19	49.9 g/yr	19 to 81 g/yr
2001	19	47.3 g/yr	6 to 82 g/yr
2002	11	38.0 g/yr	17 to 69 g/yr

*Only turtles captured and weighed at least twice in different years, after the first anniversary of release, were included.

On 28 July 2004, 62 head-start turtles were released at Pierce NWR. Twenty were released at Pierce Lake, 30 at Beaver Pond, and 12 at Domestic Spring Pond. None of these turtles were fitted with transmitters. Results from the annual trapping effort will provide information on the condition of the western pond turtle population at Pierce NWR. The goal is to establish a self-sustaining population of pond turtles at Pierce NWR including 200 adults. To date, 250 turtles have been released with an estimated current population of approximately 229 animals. The turtles released in 2000 should attain maturity in 2009.

Other sites in the Columbia River Gorge are currently under review for their potential as reintroduction sites for western pond turtles. The Washington State Recovery Plan for the Western Pond Turtle calls for establishment of a population at one additional site in the Columbia Gorge as a condition for downlisting this species from endangered to threatened. A proposal showing a ranking of suitable sites will be presented to WDFW and BPA in spring 2005.

The plan for reintroduction of western pond turtles at the Pierce NWR includes studies that will determine whether and how the native population of western painted turtles are affected by the addition of pond turtles. Painted turtle population demographics on the Pierce NWR are being studied. Measurements of turtles trapped in 2002, 2003, and 2004 are being compared to measurements taken by USFWS staff between 1999 and 2001. To date, there are 681 records of measurements for approximately 375 individual turtles. Marking practices for very small turtles utilize nonpermanent identifiers (in order to avoid injury), resulting in uncertainty regarding actual number of individual animals in the collective records. Turtles recaptured at least once during this five-year interval will be included in the study. Preliminary results show that when turtles are grouped by carapace length, distinct size classes are apparent, with notable differences between sexes. However, a review of the available information showing rate of growth suggests that the size classes may be a product of other factors besides age and sex. An objective is to develop parameters which can be used to determine maturity and approximate age of animals, particularly of juveniles. Baseline population information will also be useful in detecting any future changes due to interspecific competition with western pond turtles.

Objective 4: Control Bullfrogs and Other Predators.

Methods: Bullfrog eradication efforts were undertaken in 2004 at the Klickitat pond complex, where the efficacy of such work has been demonstrated. Ponds were regularly surveyed for egg masses, which were skimmed from the water surface and disposed of. Adult bullfrogs, tadpoles, and nonnative fish incidentally caught during turtle trapping activities were also removed.

The pond/lake complex in Klickitat County has benefited from ongoing work to eliminate bullfrogs and other nonnative predators, evidenced by discovery of a few wild two-year-old western pond turtles during trapping in recent years. These turtles originated from unprotected nests and survived without head-starting. Natural recruitment into the western pond turtle population is the primary objective in controlling nonnative predators, and is the ultimate indicator of success.

At the Skamania County pond complex and at Pierce NWR, bullfrogs and tadpoles captured in turtle traps and by hand were removed as opportunity arose. Egg masses observed during trapping work at Pierce NWR were skimmed from the water when time permitted. WDFW and the USFWS plan to coordinate periodic control efforts at Pierce NWR, contingent on availability of funding and personnel.

Results: At the Klickitat ponds and lake, 16 egg masses, 26 adult bullfrogs, and 2 tadpoles were collected and removed in 2004. Nine adult frogs at the Skamania pond complex and 4 adult frogs and 2 egg masses at Pierce NWR were eliminated.

Objective 5: Enhance, Restore, and Manage Habitat to Maximize Western Pond Turtle Survival and Productivity.

Methods: Habitat improvements are being carried out according to priority of need on each specific site. At the Skamania County site, mechanical mowing has been used to maintain suitable short-grass nesting habitat. Weed control is a priority at all of the sites, but especially the Skamania site, where Scot's broom threatens to overtake grassland habitat adjacent to turtle ponds. Efforts are also needed to eliminate other exotics including knapweed and yellow star thistle at the Klickitat sites, and Himalayan blackberry at Pierce NWR.

Soil sampling was conducted in 2003, and more sampling and analysis is planned for three native western pond turtle nesting sites in Klickitat, Skamania, and Pierce counties, and painted turtle nesting habitats at Pierce NWR, to identify important features of turtle nesting sites. This will aid in managing the sites for improved or expanded nesting habitat as needed after evaluation of individual sites. Western Washington University has proposed to conduct the additional sampling and analysis in 2005.

An old homestead building on the Klickitat site is still planned to be burned or demolished, with other unwanted material on the property to be removed to a local transfer station before burning takes place. Residual material left from burning will also be removed, and the disturbed area will be returned to native vegetation. An evaluation of historic significance of the site is required before approval for demolition is granted by the Columbia Gorge Commission.

Results: Plans are in place to remove the old house for habitat restoration purposes on the recently acquired parcel known as the Gunter property in Klickitat county. WDFW completed an evaluation of the historic value of the old homestead as a prerequisite for removal of the building, in accordance with Columbia River Gorge National Scenic Area rules. Additional review of the historic building is required prior to approval for this project. WDFW is currently contracting with an archeologist to complete this analysis. Removal of the house is planned for 2005 or 2006.

WDFW completed work to restore greater water flow to an old ditch that feeds the Klickitat pond complex. Dense vegetation was removed with a backhoe in September 2004, using habitat management funds. Also, approximately 5 acres of nesting habitat adjacent to important ponds were mowed.

At the Skamania County site, approximately 10 acres were hand mowed in September 2004. Scot's broom and blackberry were removed to restore and improve turtle nesting habitat adjacent to critical wetlands. Mowing was completed via a contract with the Department of Natural Resources Larch Correctional Program.

At Pierce NWR, periodic, ongoing weed control efforts were resumed in late summer 2004 by refuge staff. WDFW provided assistance in identifying important turtle habitat areas. Tractor mowing of fields reduces the loss of turtle nesting habitat to encroachment by blackberries, and eradication of giant knotweed protects against loss of native streamside vegetation. USFWS funds and performs weed control as a part of refuge management.

Summary and Conclusions

The cooperative effort to augment the two existing pond turtle populations in the Columbia River Gorge and establish western pond turtles at Pierce NWR has been highly successful. Trapping results for 2004 show that the head-start program has made a very large contribution toward recruitment of young turtles

into the population. Of the 203 turtles captured at the Klickitat sites, 166 (82%) were head-start turtles. At the Skamania site, 82% of the 59 turtles captured were head-starts of various ages.

Trapping results also suggest that survival of head-started turtles is high. At the time trapping was conducted, a total of 307 head-start turtles had been released since 1991 at the Klickitat sites. Fifty-four percent of these were recaptured in 2003. At the Skamania site, 33% of the 146 head-start turtles released were recaptured. The 2004 trapping effort at Pierce NWR captured 83 (44%) of the 188 turtles that had been released at the site. Actual survival rates are higher; not all turtles present are captured in traps.

The monitoring of wild adult female western pond turtles during the nesting season is the foundation of the head-start program. The 21 nests identified in 2004 were found by regularly locating female turtles by radio telemetry. These nests are the source of the eggs for head-starting. The 33 nests found in 2003 yielded 138 hatchlings, which were reared for the 2004 release by Woodland Park Zoo and The Oregon Zoo. The twenty-one nests found in 2004 produced 85 hatchlings. In spring 2004, 3 wild hatchlings were captured in traps and placed in the head-start program, for re-release in 2005.

The reintroduction of western pond turtles at Pierce NWR is in its fifth year, and is showing positive results. Of the 188 juvenile pond turtles released from 2000 through 2003, 83 of them (44%) were recaptured in spring 2004. Turtles released in 2000 gained an average of 34.3 g/yr in approximately 4 years, for a mean weight gain of 154% since release. Turtles released in 2001 gained an average of 100% in approximately 3 years, and turtles released in 2002 gained an average of 45% in two years. Turtles released in 2003 showed a mean growth of 6%. A low growth rate among first-year turtles was also observed in 2003.

Monitoring juvenile pond turtle movements over four years at Pierce NWR has shown a pattern of seasonal migration to and from the water. The turtles began to leave the ponds with the onset of drought conditions in late summer. They headed upland, where they usually continued to move until entering winter dormancy. By early November, 75-100% of the turtles being monitored were upland and dormant. The few turtles over-wintering in the ponds made only short moves and remained a few meters from shore. Some of the turtles occupied low-lying sites which periodically flooded during winter. In 2004 two turtles actively moved back to water in midwinter, much earlier than usual. One of these animals moved upland again. Such observations suggest flexibility in adjustment to environmental changes during the dormant season. Turtle movement resumed as weather warmed in late winter. The turtles gradually re-entered the ponds beginning in early March, with the last turtles returning to water by mid May. In 2004, most of the turtles returned to the same ponds they occupied the previous summer. As the data collection part of the telemetry study of juvenile western pond turtle habitat use drew to a close, the size of the study group diminished. Transmitters nearing the end of battery life were not replaced and by late August 2004 only 2 animals still had functioning transmitters.

Three documented mortalities occurred among transmitter-equipped juvenile pond turtles between July 2003 and 30 August 2004. Two animals were from the 2001 cohort. One was lost to predation, and another possibly to predation. One turtle from the 2002 cohort died of unknown causes. One additional turtle with an inactive transmitter was crushed by a vehicle.

Trapping results indicate that the native population of painted turtles at Pierce NWR is large, and that these animals also move around the refuge. Turtle measurements in trapping records from 1999 through 2004 are being analyzed for demographic and growth information, to determine the baseline condition of the painted turtle population. Examination of painted turtle demographics and growth patterns will aid in detecting any future changes in the painted turtle population that may be related to presence of western pond turtles. The two species of turtles intermingle freely, sharing the same basking spots and other favored habitats.

Removal of nonnative predators is a key objective for improvement in survival rates for hatchling pond turtles. A program of eliminating tadpoles and adult bullfrogs, surveying ponds every other day for presence of egg masses, and skimming egg masses from the ponds has proven effective in reducing the bullfrog population at the Klickitat sites. In 2004, renewed bullfrog control efforts there eliminated 26 adults, 2 tadpoles and 16 egg masses. These measures were also implemented at wetlands in Skamania County as opportunities arose incidental to other work.

Habitat improvement projects vary according to site-specific needs. About 10 acres were mowed by a contract crew at the Skamania County site to recover and maintain grassy nesting habitat. Mowing was also completed on about 5 acres adjacent to ponds at the Klickitat County site. Greater water flow was restored by cleaning a ditch that feeds the pond complex. Arrangements are being made for removal of an unwanted building on part of the Klickitat County site, to free space for supplementation of natural habitat. Weed species, including Scot's broom, yellow star thistle, and Himalayan blackberry are identified and targeted for control according to need at the particular sites. Studies of soils at turtle nesting sites will determine common characteristics, to aid in maintaining and developing turtle nesting habitat.

The success of the western pond turtle project in the Columbia Gorge is due to the interest and commitment of effort and resources by many people and organizations. The contributions of all parties are gratefully acknowledged.

Summary of Expenditures

The following summary covers the contract period of 1 October 2003 to 30 September 2004. This information includes billing through 15 October 2004 (Table 7).

Table 7. Summary of BPA funded expenditures October 1, 2003 – September 30, 2004 (approximate)

Object A – Salary	$48,773
Object B – Benefits	11,534
Object C – Contract	8,215
Object E – Equipment	1347
Object G – Travel	647
Total Expend	$70,516
Agency OH	14,215
Contract Total	$84,731