SPRING RIVERS

ECOLOGICAL SCIENCES, LLC

Northwestern Pond Turtle Protection Plan

2006 Annual Report

Pit 1 Hydroelectric Project (FERC No. 2687)

March 2007

Prepared by:

SPRING RIVERS ECOLOGICAL SCIENCES, LLC
Post Office Box 153
Cassel, California 96016
phone (530) 335–5446
fax (530) 335–4591

Prepared for:

PACIFIC GAS AND ELECTRIC COMPANY
Technical and Ecological Services
3400 Crow Canyon Road
San Ramon, California 94583

EXECUTIVE SUMMARY

The Northwestern Pond Turtle Protection Plan (Plan) was developed in compliance with the Federal Energy Regulatory Commission license for Pacific Gas and Electric Company's Pit 1 Hydroelectric Project in Fall River Mills, California. The Plan, as required by Article 421 of the license, entails monitoring of northwestern pond turtles in project-affected reaches to determine if measures are necessary to protect them from potential impacts associated with the flow regimes and ramping rates required by the license. As in 2004 and 2005, a combination of visual surveys and trapping was employed to monitor turtle population distribution, abundance, demographics, recruitment, and habitat preferences in 2006, the third year of monitoring. Surveys and trapping were conducted in Fall River Pond and reaches of the Pit River where turtles had been found previously.

As in previous years, turtle densities determined from visual surveys were greater by an order of magnitude in Fall River Pond compared to the Pit River locations. This difference is attributable to differences in the hydrology and channel morphology of Fall River Pond and the Pit River, which directly affects the quantity and quality of available turtle habitat. As in previous monitoring years, in 2006 turtles were distributed throughout Fall River Pond. Turtles in the Pit River were less evenly distributed than in Fall River Pond, and were found in the same low-velocity locations as described in 2004 and 2005. Most of the turtles observed in the Pit River could be grouped into three subpopulations that were associated with areas of suitable habitat.

The demographics of the turtle subpopulations in both Fall River Pond and the Pit River continued to exhibit skew towards larger/older classes, as expected for long-lived species with high juvenile mortality and high adult survivorship. The presence of juvenile turtles (2–5 years old) in the traps indicated that successful reproduction and recruitment has occurred in recent years. After three years of the current license flow regimes, including summer flushing flows, northwestern pond turtle subpopulations in the affected reaches of the lower Fall River and the Pit River have remained stable in terms of size, distribution, and demographics.

TABLE OF CONTENTS

EXECUTIVE SUMMARY .... **ii**

LIST OF FIGURES .... **iv**

LIST OF TABLES .... **v**

INTRODUCTION **1**

METHODS **4**
- Visual Surveys 4
- Trapping 5
- Mark-Recapture 10

RESULTS **10**
- Fall River Pond 10
- Pit River 12
- Multi-Year Compilation 12
  - Fall River Pond 16
  - Pit River 16
- Population Structure 19

DISCUSSION **22**
- Distribution and Population Density 22
- Population Structure 25
- Summary 26

LITERATURE CITED **27**

APPENDIX A—FERC License Articles (including California Water Board Conditions) pertaining to Northwestern Pond Turtles **A-1**

APPENDIX B—Northwestern Pond Turtle Marking Form **B-1**

APPENDIX C—Sexual Dimorphic Characteristics **C-1**

LIST OF FIGURES

Figure 1 Pit 1 Northwestern Pond Turtle Monitoring Plan Study Area (shaded). 3

Figure 2 Study Area with turtle subpopulations (shaded) and trapping sites (dots). 7

Figure 3 Northwestern pond turtle shell morphology showing numbering system schema and scute indentification (adapted from Holland 1994). 9

Figure 4 2006 northwestern pond turtle sighting locations (dots indicate one or more turtles) in Fall River Pond. 11

Figure 5 Length-frequency (a) and age-frequency (b) distributions of northwestern pond turtles captured in Fall River Pond (n = 23) in 2006. In the length-frequency distribution (a), X-axis values represent the lower limit for each size class. 13

Figure 6 2006 northwestern pond turtle sighting locations (dots indicate one or more turtles) in the Pit River, including subpopulations (shaded areas) and clusters (elipses). 14

Figure 7 Length-frequency (a) and age-frequency (b) distributions of northwestern pond turtles marked in Pit River (n = 37) in 2006. In the length-frequency distribution (a), X-axis values represent the lower limit for each size class. 15

Figure 8 Turtle distribution on Fall River Pond for all monitoring years. Observed turtles equals mean number observed per survey. 17

Figure 9 Turtle distribution within the upper Pit River subpopulation and the upper Pit 1 Canyon for all monitoring years. Observed turtles equals mean number observed per survey. 18

Figure 10 Turtle distribution within the middle Pit River subpopulation for all monitoring years. Observed turtles equals mean number observed per survey. 19

Figure 11 Turtle distribution within the lower Pit River subpopulation for all monitoring years. Observed turtles equals mean number observed per survey. 20

Figure 12 Size-frequency distributions of all turtles captured in (a) Fall River Pond (n = 105) and (b) the Pit River (n = 231) in all monitoring years. X-axis values represent the lower limit for each size class. 21

Figure 13 Age-frequency distributions of all turtles captured in (a) Fall River Pond (n = 105) and (b) the Pit River (n = 231) in all monitoring years. 22

LIST OF TABLES

Table 1 Chronology, reach, and method of visual surveys in 2006..4

Table 2 Locations and chronology of 2006 trapping events...6

Table 3 Number of turtle sightings during visual surveys in Fall River Pond and Pit River study reaches for all monitoring years (grid represents weeks of the month during which surveys were done). 16

Table 4 Length statistics and demographics of all captured turtles in all monitoring years....20

INTRODUCTION

The Federal Energy Regulatory Commission (FERC) issued Pacific Gas and Electric Company (PG&E) a license for the Pit 1 Hydroelectric Project, FERC No. 2687 (Project) in Fall River Mills, California on 19 March 2003. In compliance with Article 421 of the license, PG&E developed the Northwestern Pond Turtle Protection Plan (Plan) to "…determine if measures are necessary to protect northwestern pond turtles from potential adverse impacts associated with the flow regimes in California Water Board Conditions 8, 11, and 13; and the reduction of maximum generator loading and unloading rates required by California Water Board Condition 12." Article 421 is included in its entirety and Water Board Conditions 8, 11, and 13 are described fully in Appendix A. The license-required flows are:

1) Continuous flow releases from the Pit 1 Forebay into the lower Fall River, and through to the Pit River, with minimum instantaneous flows (as measured at the Fall River Weir) that vary between 50 to 150 cubic feet per second (cfs) depending on the time of year (Condition 8).
2) Combined flow of the Pit River and the Pit 1 Powerhouse during normal operations must meet or exceed a daily average of 700 cfs as recorded at the U. S. Geological Survey's (USGS) gage on the Pit River downstream of the Pit 1 Powerhouse (#11-3550.10) (Condition 11 as modified by Article 402).
3) Specified generator ramping rates of the Pit 1 Powerhouse (Condition 12).
4) Flushing flows of 1250 cfs or the natural flow to the Pit 1 Forebay, whichever is less, released through Fall River Pond for two consecutive weekend days three times a year (Condition 13).

The new license-required flows were implemented in spring of 2003, following the issuance of the license. FERC modified and approved the Northwestern Pond Turtle Protection Plan on 19 February 2004.

The northwestern pond turtle (*Emys* [=*Clemmys*] *marmorata marmorata*) is a federal species of concern and a California species of special concern because of a decline in number associated with habitat destruction (Jennings and Hayes 1994). Northwestern pond turtles were not monitored in the Project vicinity prior to the license, so there are no baseline data on the distribution, abundance, or size and age structure of turtle populations in the Project bypass reaches prior to the flow regime changes in 2003. In accordance with the Plan, a combination of visual surveys and trapping is being used to monitor potential changes in distribution, abundance, demographics, recruitment, and habitat preferences of northwestern pond turtles in response to the license conditions.

The reaches surveyed were 19.2 kilometers of the Fall and Pit rivers most affected by the license-required flow regimes (Study Area). Specifically, these reaches included: Fall River Pond, lower Fall River between Fall River Pond and the confluence with the Pit River, the bypassed reach of the Pit River from the confluence with Fall River to the Pit 1 Powerhouse tailrace (Pit 1 Bypass Reach), and the Pit River from the Pit 1 Powerhouse tailrace to Lake Britton (Figure 1). These reaches range in elevation from 3200 feet (i.e., Fall River Pond) to 2730 feet (Pit River at Lake Britton).

The Plan called for extensive visual surveys for turtles throughout the entire length of each reach in year one (2004) to establish baseline data and determine habitats used by northwestern pond turtles (see Spring Rivers 2005). If turtles were found in year one, survey efforts in years two through five were to focus on the portions of the reaches where turtles were found. An intensive trapping and mark-recapture effort was to be done in areas of high turtle density in years one and two to estimate population size and assess population demographics (see Spring Rivers 2006). The Plan provides for continued monitoring of northwestern pond turtles at five-year intervals (starting in year eight) throughout the 40-year life of the license (i.e., years 8, 13, 18, 23, 28, 33, and 38) in order to monitor population size and demographic trends within the waters affected by the license conditions.

This third annual report of the Northwestern Pond Turtle Protection Plan provides monitoring results from visual surveys and trapping in 2006 and compares and discusses these data with the 2004 and 2005 results. Data from these first three years of the monitoring effort have begun to define the range, abundance, and size distribution and age structure of the northwestern pond turtle subpopulations within the Study Area under the license-required flow regimes.

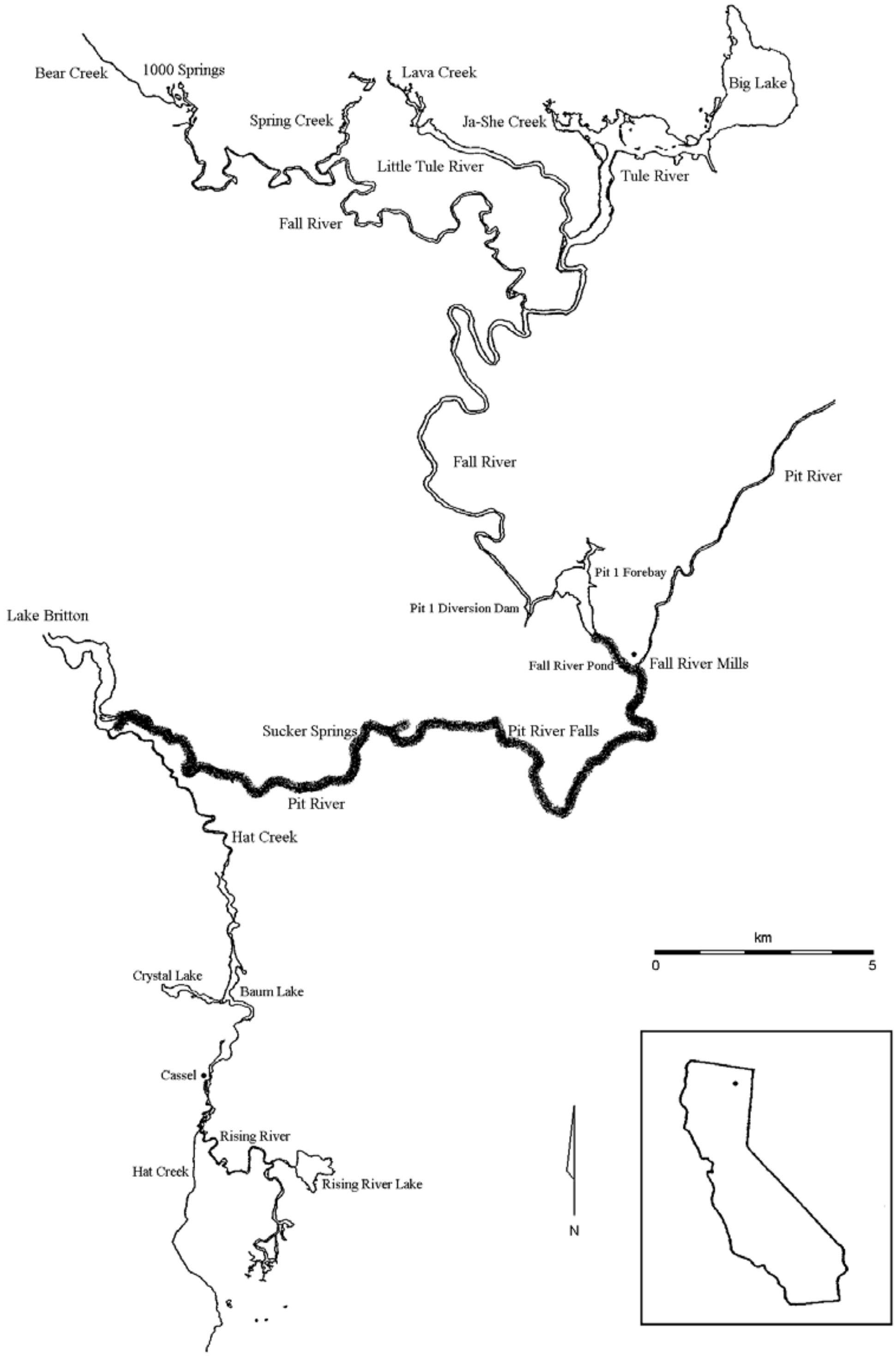

Figure 1 Pit 1 Northwestern Pond Turtle Monitoring Plan Study Area (shaded).

METHODS

Visual Surveys

The distribution and relative abundance of turtles were monitored using visual surveys. Two visual surveys were done in 2006 in five reaches where turtles were found during the full reach surveys of 2004 (Spring Rivers 2005). The reaches, designated by river kilometers (RK) originally established in the 1980s for Bald Eagle surveys (BioSystems 1985), were in Fall River Pond (RK 1.4–0.3) and in the Pit River (RK 93.8–89.8, RK 89.1–88.5, RK 87.8–87.5, and RK 83.5–76.0). The surveys were timed to occur before the first, and after the last, of the three license-required flushing flows routed through Fall River Pond and the Pit 1 Bypass Reach (i.e., before 16 June and after 20 August 2006). In 2006, the first visual survey was conducted during 5–14 June; the second was from 29 August through 6 September (Table 1). In portions of the Study Area that were comprised of long stretches of slow, flat water, such as Fall River Pond and the Pit River between the Fall River-Cassel Road Bridge (~200 meters upstream of the Fall River confluence) and lower Big Eddy, surveys were done from a canoe in a downstream direction. All other sections were surveyed on foot (i.e., pedestrian surveys) in an upstream direction.

Table 1 Chronology, reach, and method of visual surveys in 2006.

	Date	Location	River Kilometer	Method	Direction
Survey 1	5 June	Lake Britton – Hwy 299	76.0 – 78.0	Pedestrian	Upstream
	7 June	Fall River Pond	1.4 – 0.3	Canoe	Downstream
	8 June	Fall River Mills – Big Eddy	93.8 – 89.8	Canoe	Downstream
	9 June	Pit River U/S of Hwy 299	78.0 – 81.1	Pedestrian	Upstream
	13 June	Upper Pit 1 Canyon	87.5 – 89.1	Pedestrian	Upstream
	14 June	Pit River D/S Pit 1 Tailrace	81.1 – 83.5	Pedestrian	Upstream
Survey 2	29 August	Lake Britton – Hwy 299	76.0 – 78.0	Pedestrian	Upstream
	30 August	Pit River U/S of Hwy 299	78.0 – 81.1	Pedestrian	Upstream
	31 August	Pit River D/S Pit 1 Tailrace	81.1 – 83.5	Pedestrian	Upstream
	1 September	Fall River Pond	1.4 – 0.3	Canoe	Downstream
	5 September	Fall River Mills – Big Eddy	93.8 – 89.8	Canoe	Downstream
	6 September	Upper Pit 1 Canyon	87.5 – 89.1	Pedestrian	Upstream

Pedestrian surveys were conducted by two surveyors, one on each side of the channel, moving parallel (i.e., even with each other) in an upstream direction while scanning ahead with binoculars. Because visibility along the near bank was often obscured by dense riparian vegetation, surveyors scanned the opposite bank ahead of the other surveyor. Two-way radios were used for communication. Canoe surveys in Fall River Pond and the Pit River from Fall River-Cassel Road to lower Big Eddy were done in a downstream direction in a zigzag pattern from bank to bank. Similar to the pedestrian surveys, the opposite bank was initially scanned with binoculars before crossing the channel for a closer inspection. In the wide pond-like areas of Big Eddy, in addition to the zigzag pattern, the canoe was paddled around the perimeter before continuing downstream.

Visual surveys were conducted on days when northwestern pond turtles were considered likely to be active (e.g., at least partly sunny and warm). The location and behavior (basking or foraging) of each turtle were recorded on field maps (which included tic-marks at every tenth of a river kilometer). For analysis, the location of each turtle was assigned to the nearest downstream tenth of a river kilometer. For instance, a turtle observed between RK 81.1 and 81.2 would have been recorded at RK 81.1. Air and water temperatures and general weather conditions were recorded at the beginning of each survey.

Trapping

Although the Plan does not specifically require that trapping be continued beyond the first two years of the study, trapping efforts were continued because the method provides the most reliable means of assessing reproductive success (i.e., juvenile recruitment) and demographic trends, which are called for in the Plan. Within the higher population density areas, turtles were trapped during the summer season when turtles are most active (Table 2) to provide information on the size and age structure of the turtle population and to assess juvenile recruitment.

In 2006, 14 trapping sites (Figure 2) were chosen within the Study Area to sample the four subpopulations that were initially designated in 2004 and described in detail in 2005. Breaks between subpopulations were originally recognized during the data analysis after the first full year of surveys (2004). These were based on gaps, i.e., distances, between turtle sightings and differences in habitat (Spring Rivers 2005). The upstream-most subpopulation is comprised of turtles resident in Fall River Pond (RK 0.3–1.4). Fall River Pond is separated from the Pit River by 300 meters of cascade habitat, which is unsuitable for northwestern pond turtles. The remaining three subpopulations were in the Pit River portion of the Study Area. The boundaries of the upper subpopulation were delineated at Fall River-Cassel Road Bridge and the entrance of the Pit 1 Canyon (RK 93.8–89.8); the middle subpopulation occupied the Pit River from just downstream of the Pit 1 Powerhouse tailrace to approximately 0.5 km downstream of Sam Wolfin Spring (RK 82.8–80.3); the lower subpopulation occupied the portion of the Pit River from 0.8 km upstream of Highway 299 Bridge to Lake Britton (RK 78.8–76.0) (Figure 2). Within the Pit River subpopulation boundaries, clusters of turtles were defined at specific sites where five or more turtles had been seen on two or more occasions.

Table 2 Locations and chronology of 2006 trapping events.

Subpopulation	Date	River Kilometer
Fall River Pond	9 May[a]	0.4
	1 August	0.3
	15 August	1.0
	15 August	0.5
	16 August	1.3/1.4
Pit River Upper	19 July	92.2/92.3
	19 July	90.4
	1 August	93.8
Pit River Canyon	5 September	89.0
Pit River Middle	7 July	82.5
	7 July	81.1
	18 July	80.6
Pit River Lower	6 July	78.6
	6 July	78.0
	18 July	77.2
	22 July	77.7

[a] single-trap event done in conjunction with another study; two turtles captured.

Eleven of the trapping sites had been sampled previously; three new sites were selected in order to more evenly sample the subpopulations. One of these new sites was also selected because of its potential to show migration from the Fall River subpopulation into the upper Pit River subpopulation (Figure 2, RK 93.8). Similarly, an additional trapping site was added in 2006 in

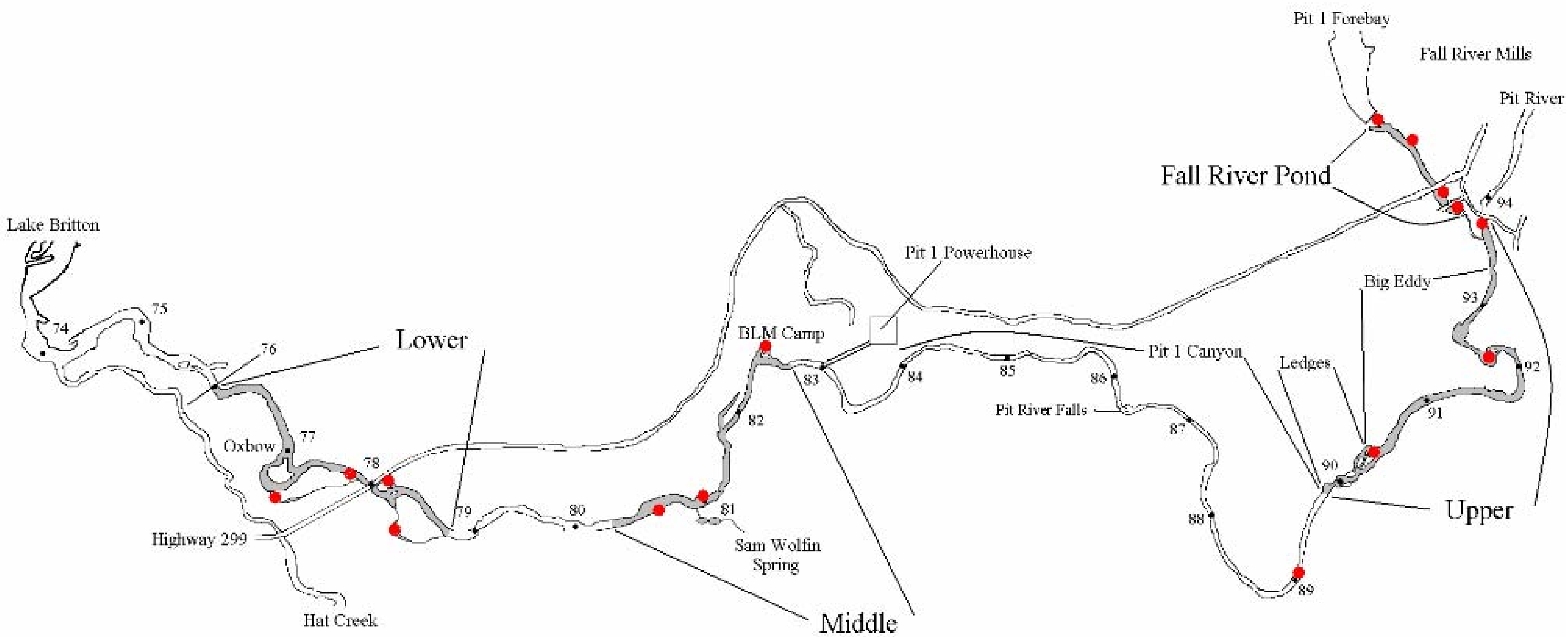

Figure 2 Study Area with turtle subpopulations (shaded) and trapping sites (dots).

the Pit River Canyon between the upper and middle Pit River subpopulations (Figure 2, RK 89.0) to investigate the possibility that turtles marked in Big Eddy in the upper subpopulation could either migrate or be displaced downstream.

Two turtles were incidentally captured in a single trap that was set in Fall River Pond to catch crayfish in an unrelated effort. Although the level of effort at this location was not equal to the trapping sites, the turtles caught in the trap were marked and included in the Fall River Pond trapping data (Table 2, 9 May event).

All sites were trapped once using six traps, with the exception of the 16 August event in Fall River Pond, during which 12 traps were set. We used collapsible nylon net traps with funnel-shaped entries, the openings of which were enlarged and dorsoventrally compressed to better accommodate the turtle body shape. Traps were baited with sardines in punctured film canisters, set in the afternoon and collected the following morning. Traps were staked or tied off in water of sufficient depth to submerge the openings, but with a portion of the trap exposed above the water so that trapped turtles could breathe. Because many trapping locations were too deep to rest the trap on the substrate, inflated bicycle-tire inner tubes were attached to all traps to ensure that they floated and provided adequate breathing space.

Data recorded for each trapping event included date, location, trap set and collection times, general weather conditions, water temperature, turbidity, and velocity. For each turtle captured, the following data were recorded: sex, weight, estimated age, and maximum shell length, width, and height (sample data sheet in Appendix B). The dorsal half of the turtle shell (i.e., carapace) is larger than the ventral half (i.e., plastron) and has the maximum length and width dimensions (Figure 3). Height is the maximum dorsoventral dimension. Carapace length (CL), width, and height measurements were taken to the nearest millimeter with vernier calipers. Height measurements were approximated for turtles greater than 125 mm CL, because the jaws of the calipers were generally too short to extend from any edge of the carapace to the dorsoventral maximum of the turtle. Mean numbers and sizes are presented as mean ± standard deviation. Sex was determined by assessing secondary sexual characteristics, which develop on

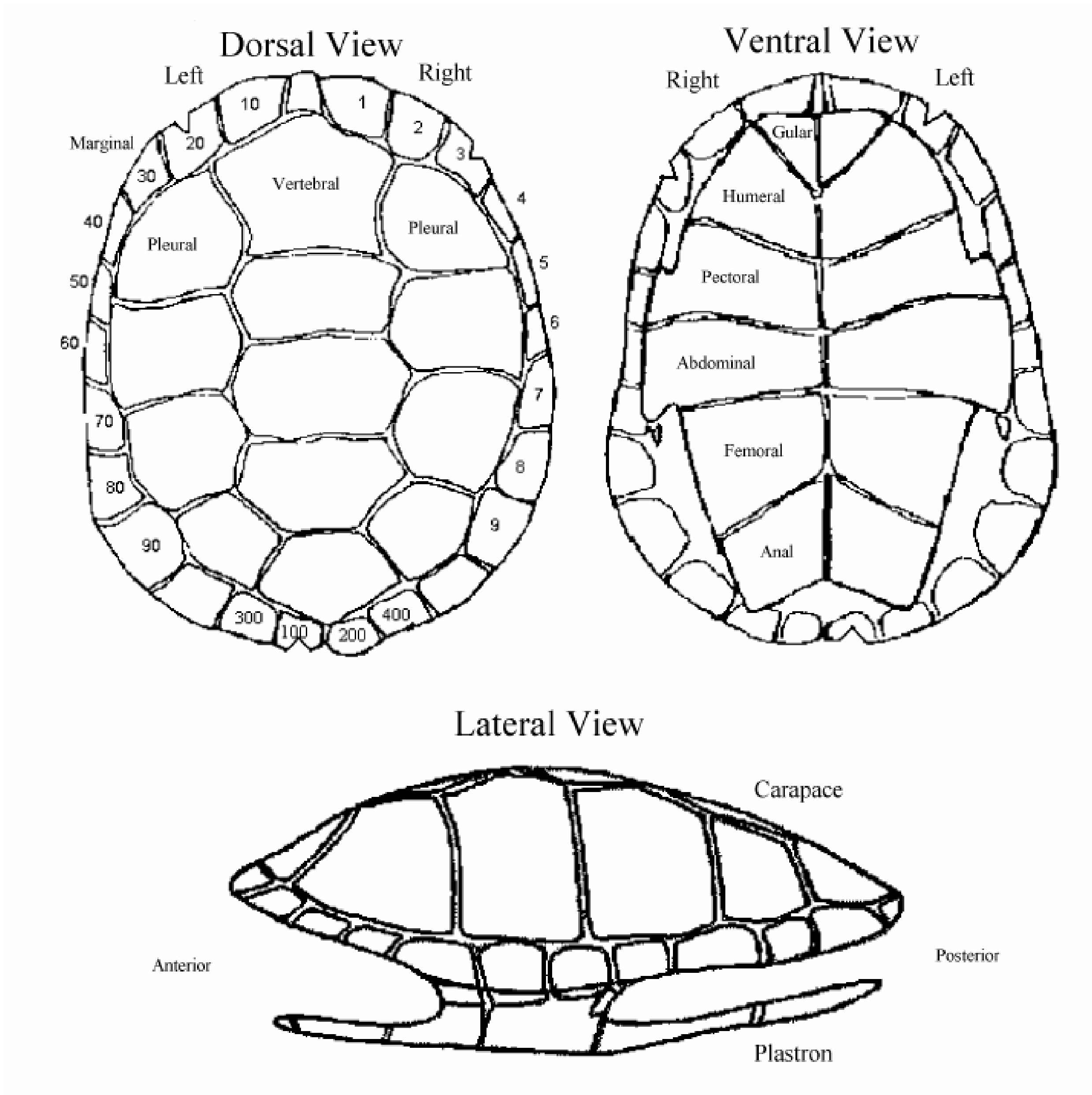

Figure 3 Northwestern pond turtle shell morphology showing numbering system schema and scute indentification (adapted from Holland 1994).

northwestern pond turtles at maturity (Appendix C). Weight was measured with a Pesola spring scale (accuracy ±5 g). Age of each turtle was estimated by counting annuli (annual growth rings) on one or more scutes of the ventral (plastron) and/or dorsal (carapace) surface of the turtle's shell (Bury and Germano 1998). Turtles with smoothed plastrons and only partially readable annuli were recorded as 15+ years, and turtles with completely smooth plastrons and unreadable annuli were recorded as 20+ years (Bury and Germano personal communication, 25 June 2004).

Mark-Recapture

Trapped turtles were individually marked with numerical identification codes by filing a notch no deeper than 5 mm into the marginal scutes with a small triangular file. The marking and numbering system are shown in Figure 3. For example, the 100, 20, and 3 marginal scutes were notched to identify turtle number 123 in Figure 3. On turtles less than 100 mm CL, marking was avoided on the fifth and sixth marginal scutes because the horny shell material is thin along the near-vertical sides of the shell and even shallow notches could injure the turtle. Instead we used the next available larger numbers to mark these smaller turtles (e.g., if the next available number was 45, a small turtle would have received the number 47, leaving the numbers 45 and 46 to be used on larger turtles captured later). In 2006, numbering of turtles trapped in Fall River Pond and the Pit River was continued from the last numbers used in those reaches in 2005.

RESULTS

Fall River Pond

As in previous years, turtles were found throughout Fall River Pond during the visual surveys in 2006 (Figure 4). Ninety-eight turtles were observed during the first survey and 94 during the second. Population density (i.e., number of turtles observed per kilometer of river surveyed) averaged about 80 turtles/km for the length of Fall River Pond.

Trapping efforts on Fall River Pond yielded a total of 23 turtles in six events, including two recaptures. Captured turtles ranged from 68 to 183 mm CL (mean = 127 ± 42 mm). The 21 turtles marked included 13 juveniles, 3 females, and 5 males. Both of the recaptured turtles were male and both were captured in the same locations where they were originally captured and

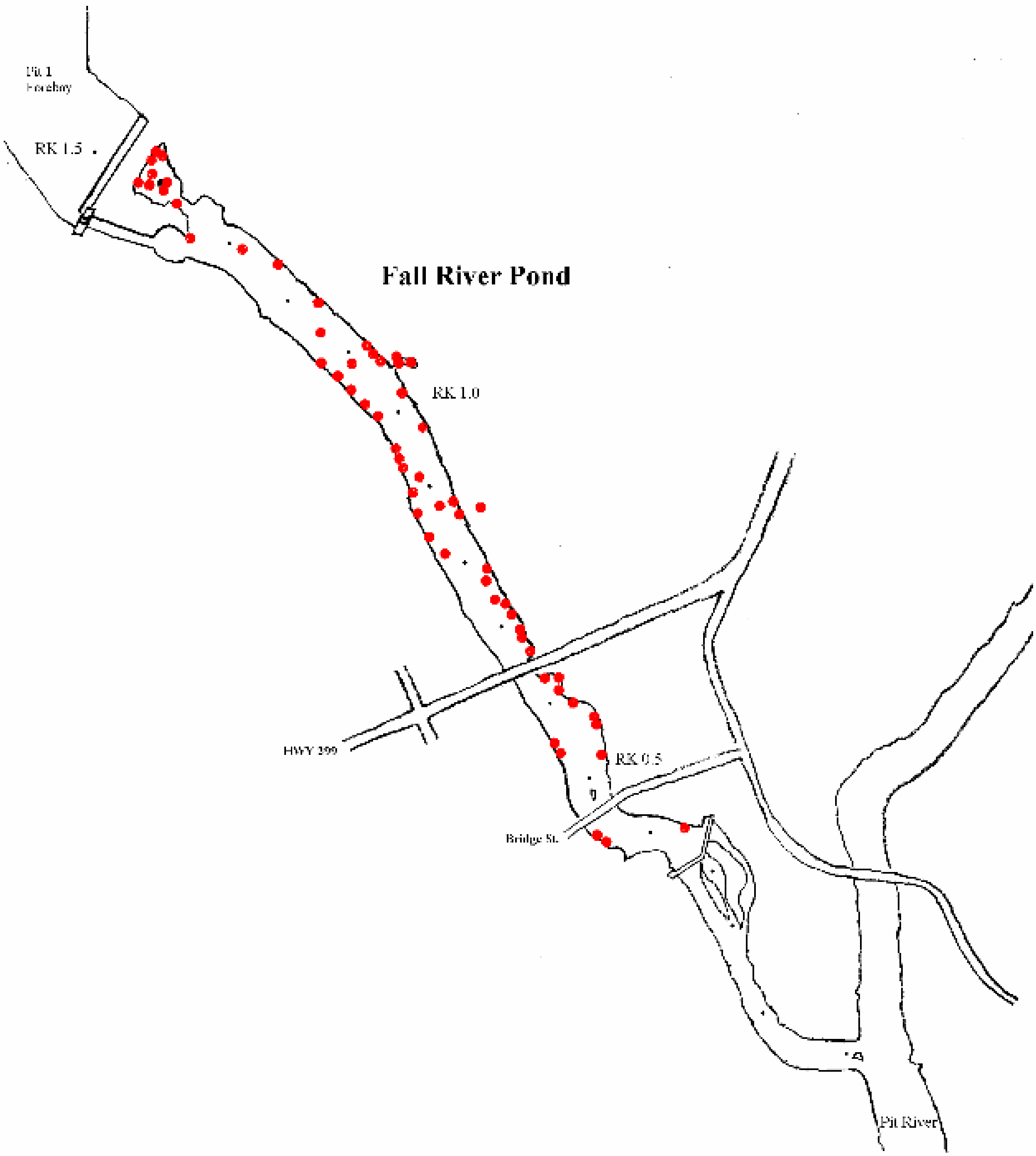

Figure 4 2006 northwestern pond turtle sighting locations (dots indicate one or more turtles) in Fall River Pond.

marked in 2004. Figure 5 shows the length-frequency and age-frequency distributions of turtles captured in Fall River Pond in 2006.

Pit River

In the Pit River, 94 turtles were observed during the first visual survey in 2006 and 83 turtles were observed during the second. Turtles were generally found in the same low-velocity (mostly still-water) pools, side channels, and isolated ponds in 2006 as in 2004 and 2005 (Figure 6). In addition to the subpopulations and clusters previously identified and described in the 2005 annual report (Spring Rivers 2006), one additional site at RK 93.8 qualified as a cluster in 2006. As in previous years, individuals and small groups of 2 to 3 turtles were again encountered at various locations both within and outside of the designated subpopulation boundaries. The individuals and small groups were generally found in slow, edge-water pockets of habitat along faster portions of the river.

The Pit River turtle population density calculated in 2006 was approximately seven turtles/km. This density estimate accounts only for the 12.4 kilometers of the Pit River that were surveyed. It does not include the 5.4 kilometers that were not surveyed because turtles were not found in those sections in 2004 (see Discussion).

Trapping efforts on the Pit River focused on cluster locations in the upper, middle, and lower subpopulations. Thirty-seven turtles, including 15 recaptures, were trapped in 11 overnight events. The 15 recaptures included eight that were marked in 2004 and seven that were marked in 2005. All 15 were recaptured at their original point of capture; no movement within or between subpopulations was documented in 2006. Captured turtles ranged from 79 to 177 mm CL (mean = 137 ± 33 mm). The 22 turtles marked in 2006 included six juveniles, nine females, and seven males. Figure 7 shows the length-frequency and age-frequency distributions of the turtles captured in the Pit River in 2006.

Multi-Year Compilation

Nine visual surveys have been completed on Project reaches affected by the current license-required flow regimes in the first three years of the Plan implementation. Four complete reach

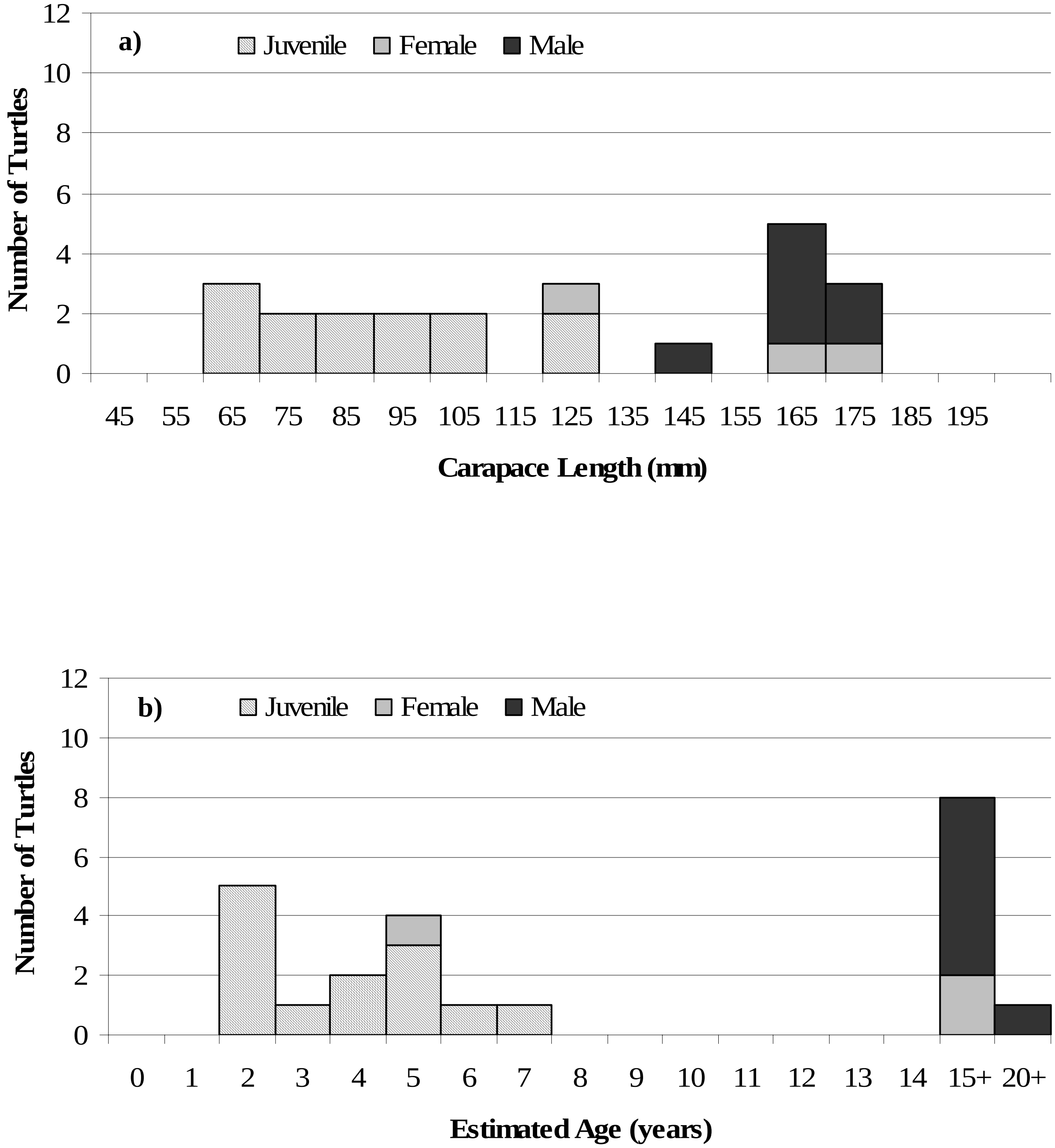

Figure 5 Length-frequency (a) and age-frequency (b) distributions of northwestern pond turtles captured in Fall River Pond (n = 23) in 2006. In the length-frequency distribution (a), X-axis values represent the lower limit for each size class.

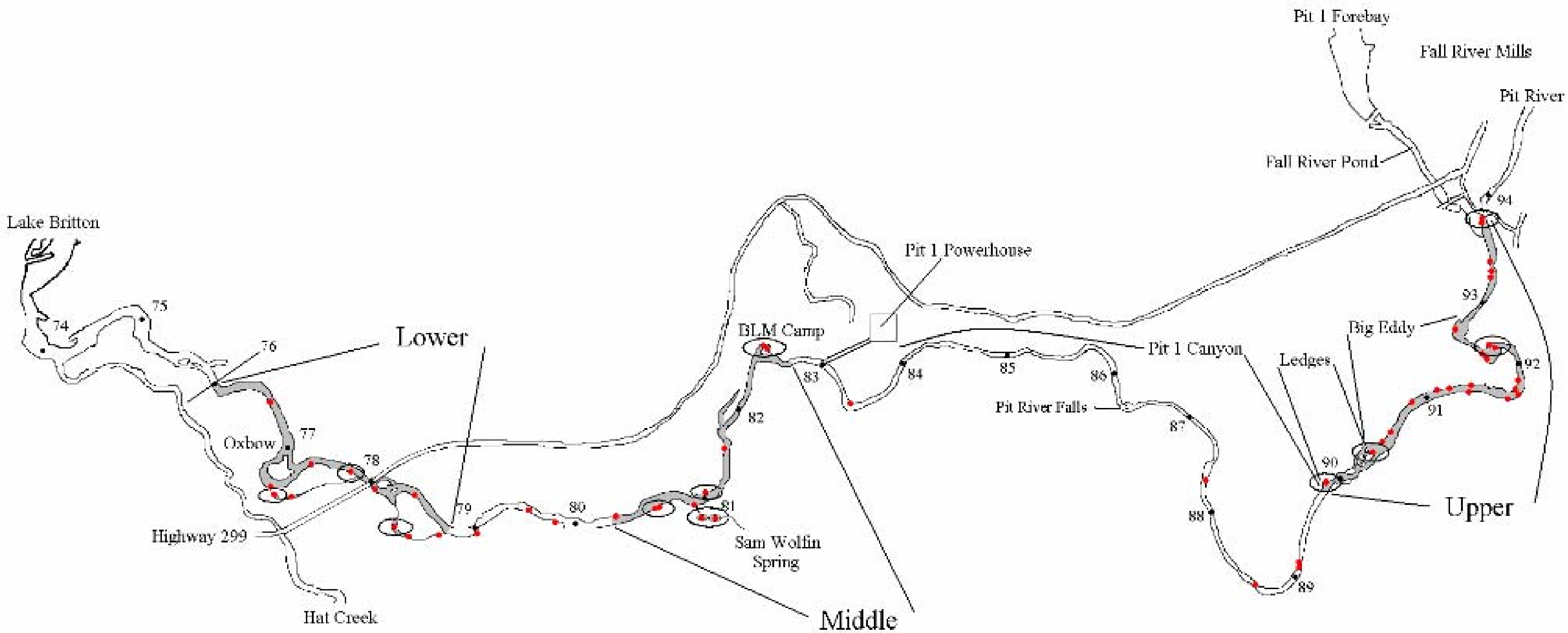

Figure 6 2006 northwestern pond turtle sighting locations (dots indicate one or more turtles) in the Pit River, including subpopulations (shaded areas) and clusters (elipses).

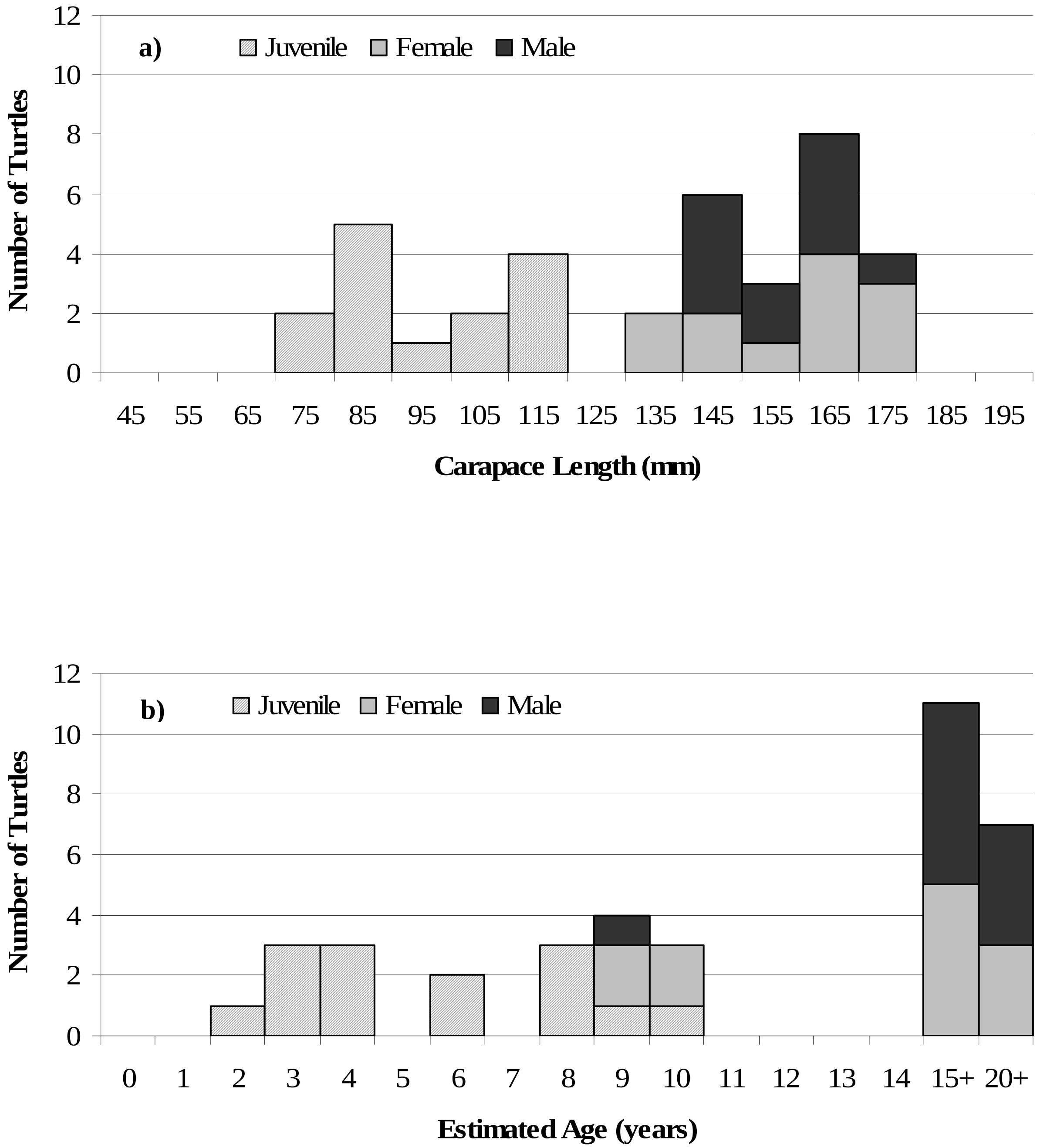

Figure 7 Length-frequency (a) and age-frequency (b) distributions of northwestern pond turtles marked in Pit River (n = 37) in 2006. In the length-frequency distribution (a), X-axis values represent the lower limit for each size class.

surveys were done in 2004, whereas surveys in 2005 (three) and 2006 (two) covered reaches where turtles were found in 2004 (Table 3). Survey one in 2005 was incomplete due to high flows in the Pit River that made pedestrian surveys unfeasible prior to the first flushing flow (Spring Rivers 2006). For all the visual surveys combined, the number of turtles observed per survey in Fall River Pond averaged 91 (± 8). Observations per survey in the Pit River averaged 85 (± 4) turtles, not including those observed during the incomplete first survey in 2005.

Table 3 Number of turtle sightings during visual surveys in Fall River Pond and Pit River study reaches for all monitoring years (grid represents weeks of the month during which surveys were done).

<table>
<tr><th></th><th></th><th colspan="4">May</th><th colspan="4">June</th><th colspan="4">July</th><th colspan="4">August</th><th colspan="4">September</th></tr>
<tr><td rowspan="3">Fall River Pond</td><td>2004</td><td>79</td><td></td><td></td><td>98</td><td></td><td></td><td>102</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>57</td><td></td><td></td></tr>
<tr><td>2005</td><td></td><td></td><td></td><td></td><td>76</td><td></td><td></td><td></td><td></td><td></td><td>102</td><td></td><td></td><td></td><td></td><td></td><td></td><td>117</td><td></td><td></td></tr>
<tr><td>2006</td><td></td><td></td><td></td><td></td><td></td><td>98</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>94</td><td></td><td></td><td></td></tr>
<tr><td rowspan="3">Pit River</td><td>2004</td><td>77</td><td></td><td></td><td colspan="2">94</td><td></td><td></td><td colspan="3">82</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td colspan="2">75</td></tr>
<tr><td>2005</td><td></td><td></td><td></td><td colspan="2">39[a]</td><td></td><td></td><td></td><td></td><td></td><td colspan="2">83</td><td></td><td></td><td></td><td></td><td></td><td></td><td>95</td><td></td></tr>
<tr><td>2006</td><td></td><td></td><td></td><td></td><td colspan="2">94</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td colspan="2">83</td><td></td><td></td><td></td></tr>
</table>

[a] Survey 1 in 2005 was incomplete due to weather

Fall River Pond

Northwestern pond turtles have been found throughout Fall River Pond in all three monitoring years, with at least one individual found in every 100-meter (i.e., 0.1 km) section of the pond (Figure 8). Distribution within Fall River Pond was not uniform, however, indicating the presence of preferred, as well as less-preferred, habitats.

Pit River

In the first three years of the study, northwestern pond turtles in the Pit River were consistently found in the same three subpopulation areas delineated in the 2005 annual report: the upper subpopulation (RK 93.8–89.8), middle subpopulation (RK 82.8–80.3), and lower subpopulation (RK 78.8–76.0). These three subpopulations were separated by river reaches that were either unsuitable for turtles or supported only a few isolated turtles.

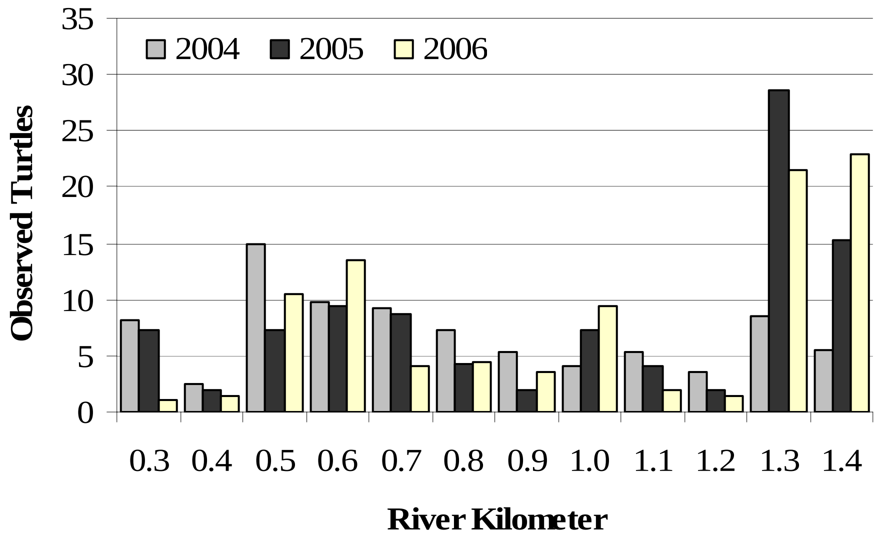

Figure 8 Turtle distribution on Fall River Pond for all monitoring years. Observed turtles equals mean number observed per survey.

The upper subpopulation is distributed throughout the slow, wide portion of the Pit River from the upper limit of the Study Area (RK 93.8) downstream to the entrance to the Pit 1 Canyon (RK 89.8) (Figure 9). Seven kilometers of river (RK 89.8–82.8) separated the upper and middle subpopulations; most of this reach (RK 89.8–84.0) was in the Pit 1 Canyon. Aquatic habitat in these seven kilometers of river is dominated by fast, turbulent water and terrestrial habitat is very steep, rocky, and uneven. With the exception of some large pools that exist within the reach, it is generally inhospitable for pond turtles. In the three years of monitoring surveys, turtles have been seen in four of these pools during individual surveys, although numbers are inconsistent from survey to survey and too small to constitute clusters.

Population centers within the middle subpopulation were concentrated around areas of the most suitable habitat and have been generally consistent over the three years. The mean number of sightings at one location, the Bureau of Land Management (BLM) Campground (RK 82.5), however, has declined steadily during the monitoring period (Figure 10).

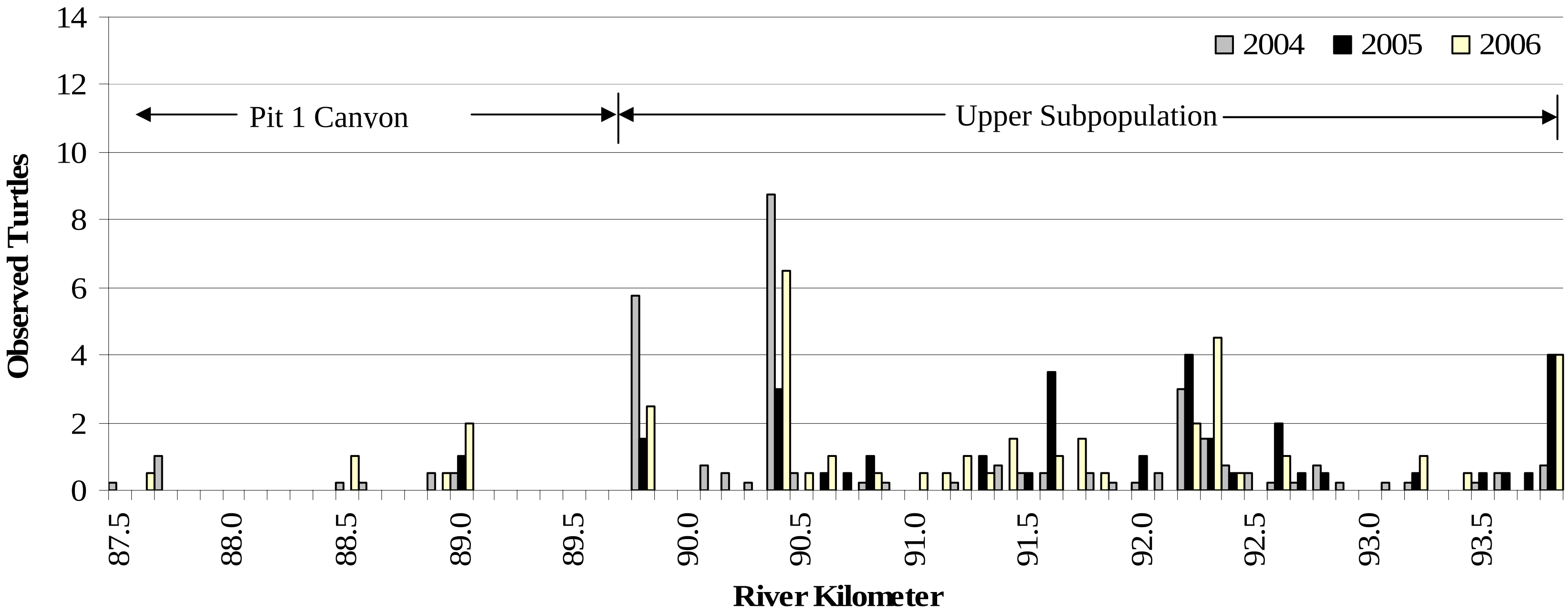

Figure 9 Turtle distribution within the upper Pit River subpopulation and the upper Pit 1 Canyon for all monitoring years. Observed turtles equals mean number observed per survey.

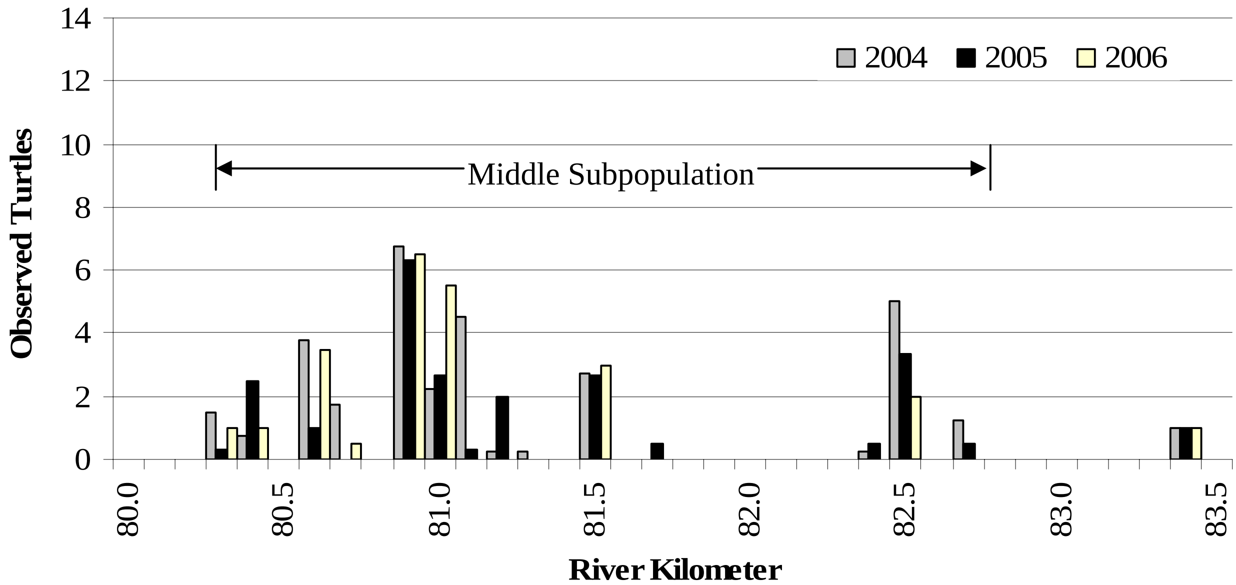

Figure 10 Turtle distribution within the middle Pit River subpopulation for all monitoring years. Observed turtles equals mean number observed per survey.

Similar to the middle subpopulation, turtle distribution in the lower subpopulation is concentrated in areas of the most suitable habitat. Three clusters dominate the distribution (Figure 11), and one of these at RK 77.2 ("Oxbow Ponds") has emerged as the most densely populated site in the Pit River portion of the Study Area, averaging 10 turtle sightings per survey over three years of monitoring.

Population Structure

Three years of trapping have yielded 336 northwestern pond turtles: 105 in Fall River Pond and 231 in the Pit River (Table 4). Figure 12 displays the size-frequency distributions for all turtles captured in Fall River Pond and the Pit River in 2004, 2005, and 2006. Turtles in the Study Area appeared to reach sexual maturity at approximately 125 mm CL. The sex ratios (juvenile:female:male), by percent, composited for all turtles captured in all years in Fall River Pond and the Pit River were 30:32:38 and 36:36:29, respectively.

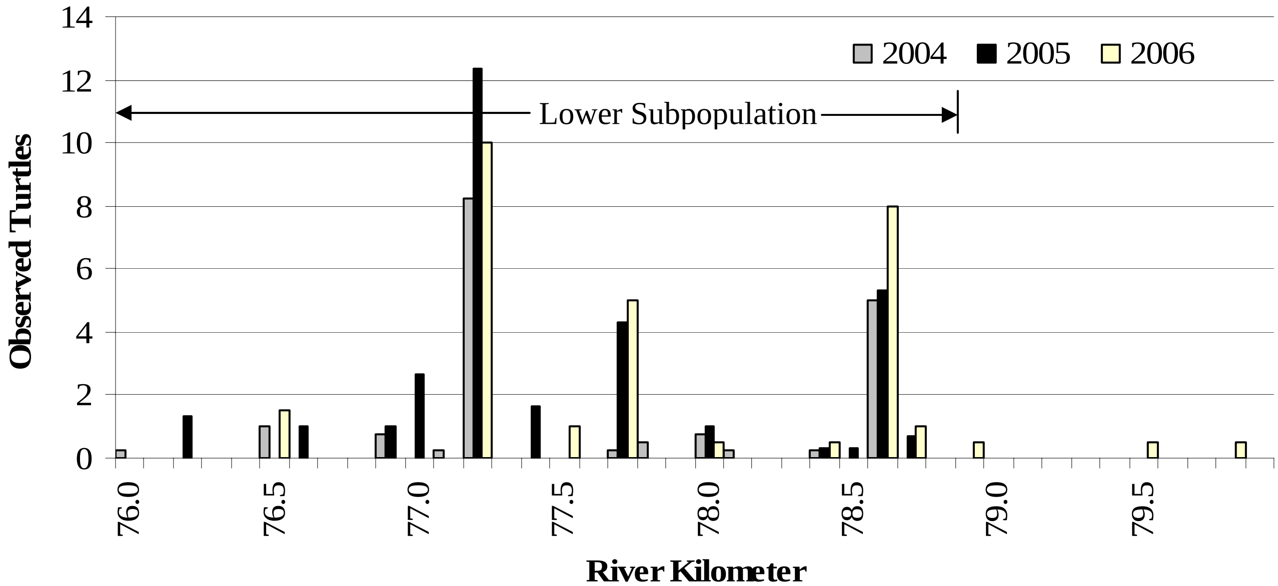

Figure 11 Turtle distribution within the lower Pit River subpopulation for all monitoring years. Observed turtles equals mean number observed per survey.

Table 4 Length statistics and demographics of all captured turtles in all monitoring years.

	Fall River Pond			Pit River		
	2004	**2005**	**2006**	**2004**	**2005**	**2006**
Carapace Length (mm)						
Minimum	56	79	68	66	67	79
Maximum	183	183	183	182	190	177
Mean ± Standard Deviation	145 ± 33	151 ± 29	127±42	135 ± 33	137 ± 35	137 ± 33
Maximum Juvenile	122	116	126	124	125	121
Minimum Adult Male	138	141	147	123	126	147
Minimum Adult Female	135	133	132	126	127	135
Turtles Captured (Marked)	41 (39)	41 (39)	23 (21)	104 (103)	90 (66)	37 (22)
Sex Ratio % (juv:females:males)	24:29:46	20:46:34	57:13:30	35:36:30	36:38:27	38:32:30
Adult %	76	80	43	65	64	62
Juvenile %	24	20	57	35	36	38
Male %	61	42	70	46	41	48
Female %	39	58	30	54	59	52

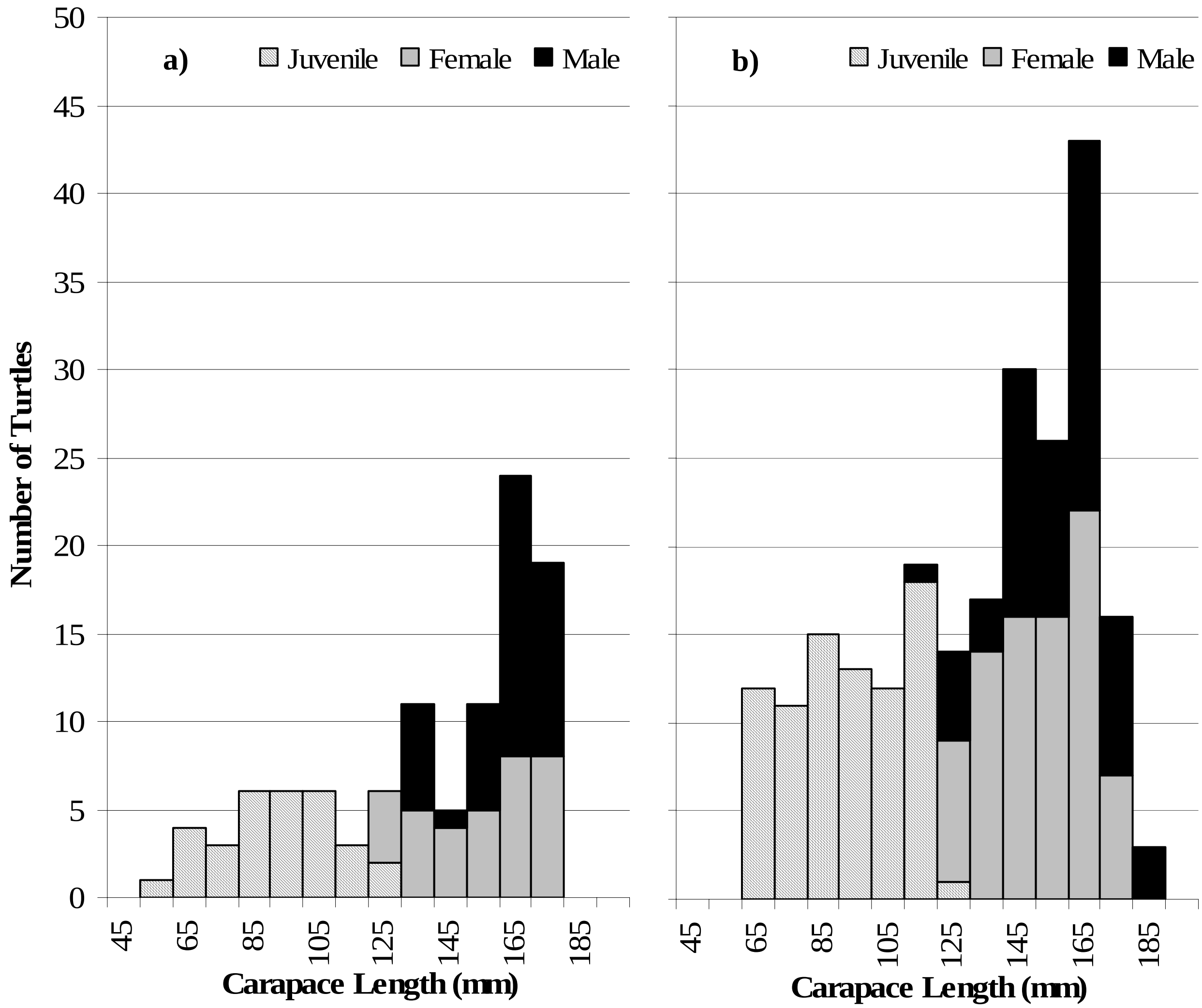

Figure 12 Size-frequency distributions of all turtles captured in (a) Fall River Pond (n = 105) and (b) the Pit River (n = 231) in all monitoring years. X-axis values represent the lower limit for each size class.

Figure 13 displays the age-frequency distributions for all turtles captured in Fall River Pond and the Pit River in 2004, 2005, and 2006. The 15+ and 20+ age classes, as determined by our methods, have been combined into the 15+ class in Figure 13 and represent all turtles that had unreadable annuli. In Fall River Pond, maturity generally occurred by age six, while maturity in the Pit River occurred over a wide range of ages; adults as young as four years and juveniles as old as 11 years were found (Figure 13).

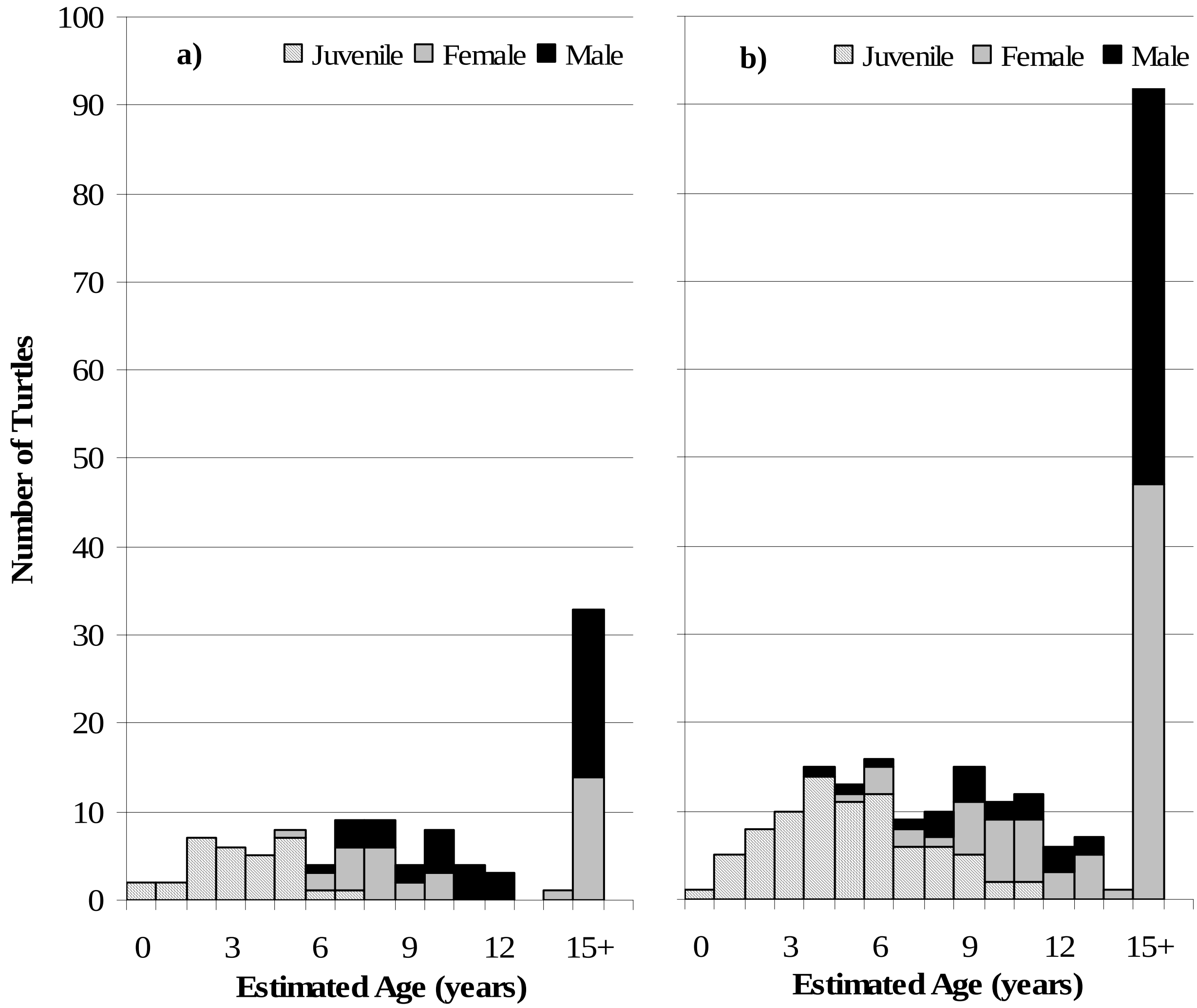

Figure 13 Age-frequency distributions of all turtles captured in (a) Fall River Pond (n = 105) and (b) the Pit River (n = 231) in all monitoring years.

DISCUSSION

Distribution and Population Density

Northwestern pond turtles were found in the greatest abundance and generally higher densities in areas with long stretches of slow, flat water, specifically Fall River Pond and Big Eddy. In the Pit River outside of Big Eddy, turtles were primarily found within more limited sections of similar habitat. Some individuals and small groups of turtles were occasionally found in even smaller or more isolated pockets of habitat surrounded and separated by large distances of unsuitable aquatic and terrestrial habitat (i.e., faster flowing water such as riffles, pocket water, and runs bordered by steep, rocky canyon walls).

Fall River Pond contained the most uniformly high-quality pond turtle habitat in the Study Area. Despite its habitat uniformity, however, northwestern pond turtle distribution was not completely uniform within Fall River Pond. The highest northwestern pond turtle population densities within Fall River Pond have been in and around the backwater just below the dam at RK 1.4–1.3. The heavy use of the backwater likely reflected the preference of pond turtles for water with little or no velocity. In contrast, the consistently lowest densities in Fall River Pond were around RK 1.2 and RK 0.4 (Figure 8). Although the reason or reasons for lower densities at these locations are not certain, turtles may avoid these areas due to either less-than-ideal habitat conditions or greater human interactions. For example, at river kilometer 1.2 turtles are likely to experience relatively high velocities resulting from water flowing down the Pit 1 Forebay Dam spillway into Fall River Pond and there is also a public boat launch and parking area at this location.

Big Eddy in the Pit River contained fairly uniform, good quality habitat throughout, but despite this, turtle population densities were lower in Big Eddy than in Fall River Pond. Habitat in the Pit River downstream of Big Eddy was much less uniform than in Big Eddy. Occasional low-velocity pools, backwaters, and off-channel ponds that provide good turtle habitat are separated by higher-gradient, swifter river reaches devoid of turtle habitat. Turtles were generally common in areas of the Pit River where low-velocity habitat exists, but they were rare or absent where such habitat was not available.

The seven kilometers of Pit River (RK 89.8–82.8) that separate the upper and middle subpopulations lies mostly in the Pit 1 Canyon, a large geographical barrier that likely prevents most, if not all, upstream movement and gene flow from the middle and lower subpopulations into the upper subpopulation. The faster and more turbulent water (i.e., riffles, pocket water, and runs) within the canyon is unsuitable habitat for pond turtles and overland travel is highly unlikely because of the steep and uneven topography. Migration and gene flow may occur from the upper subpopulation to the middle and lower subpopulations as a result of downstream migration or occasional involuntary displacement of turtles caught up in the fast water of the canyon. Northwestern pond turtles are not strong swimmers (Ashton et al. 1997) and can be swept into fast water under normal flow conditions as well as high flow events. We have witnessed turtles tumbling downstream through riffles during visual surveys, completely at the mercy of the flowing water. Turtles that move down into the canyon, either voluntarily or otherwise, are likely to search for the first suitable habitat they can find and may take up residence (at least temporarily) in the isolated areas of slow water that they encounter. Suitable nesting habitat appeared to be limited within the confines of the canyon, however, and although individuals and small groups of turtles were sighted in these isolated pools within the Pit Canyon, numbers sighted by location were variable and it is not clear if or for how long turtles remain in these areas.

Because subsequent visual surveys have been limited to the reaches where turtles were seen in 2004, densities calculated for the Pit River portion of the Study Area are based on numbers of turtles found within the reaches surveyed, not the entire reach. Turtle density averaged approximately seven turtles per kilometer for the 12.4 kilometers surveyed in 2006. If we assume no turtles were present in the reaches with less-favorable habitat that were not surveyed in 2006, then the density of turtles for the entire 17.8 kilometers of the Pit River portion of the Study Area would be approximately five turtles/km. This estimate is consistent with the mean density of 4.6 turtles/km calculated for the four full-reach surveys in 2004 (Spring Rivers 2005).

The steady declining trend in the number of turtle sightings at the BLM Campground (RK 82.5) may be significant. This is one of two sites in the Pit River where juvenile recruitment has been highest. The other site is Sam Wolfin Spring, at RK 80.9 (which was not sampled in 2006 because it was considered less representative of general Pit River conditions than other sites in the immediate vicinity). Juvenile turtles have accounted for 77% of turtles trapped at BLM Campground during the three years of monitoring and 79% at Sam Wolfin Spring during the first two years. One possible reason for the decline in turtle sightings since 2004 could be related to human activities in the area. Specifically, the BLM campground underwent a substantial reconstruction during the 2005 summer. Work activities, including the use of heavy equipment may have caused turtles to migrate away from the location. A long-term decline in the number of juvenile turtles using this site could result in a decline in turtle abundance in this section of the Pit River. Trends at this site will be closely monitored.

Population Structure

The age-distribution plots for Fall River Pond and the Pit River (Figure 13) appear to reflect fewer turtles in the 12- to 14-year age classes. While this could be interpreted as an indication of poor or failed recruitment during those specific years (i.e., 12 to16 years prior to the beginning of monitoring), it is more likely that it is related to a limitation of the aging methods. As discussed in the 2005 Northwestern Pond Turtle Annual Report (Spring Rivers 2006), the field aging methods used for these monitoring efforts (Bury and Germano 1998) have some accuracy limitations. As turtles approach their maximum size, growth slows and the annuli may become too tightly packed to be distinguishable, or the turtles may fail to deposit an annulus. Bury and Germano (1998) pointed out that growth of western pond turtles (of which northwestern pond turtles are a subspecies) appeared to slow at about 10 years of age, and annuli were generally not countable after about 12 to 14 years. Hence, turtles that approach maximum size at an early age with unreadable (compacted) annuli are grouped into the 15+ age class by our methodology. It appears from our age-distribution plots (e.g., Figure 13), which are very similar to distributions found by Germano and Bury (2001) in the Central Valley of California, that this aging method may be underestimating the number of turtles in the 12- to 14-year age classes and overestimating the 15+ class.

During 2006, another limitation of the aging method became apparent. Specifically, several of the turtles we handled and measured appeared younger than 15 years, yet they fell into the 15+ year class. On these individuals the outer (i.e., more recent and closely spaced) annuli were still clearly readable, but the earliest annuli had been worn too smooth to be readable, leaving no starting point for counting. Therefore, the age was uncountable and the turtle fell into the 15+ age class. In 2006 two turtles originally captured in 2004 and aged at 12 years old were recaptured. These turtles should have been aged at 14 in 2006, but because of unreadable early annuli were aged at 15+. In many systems, smoothing of the plastron surface due to wear may not be seen until turtles reach later ages, but in areas dominated by rough, rocky substrate, such as the Pit River, this could potentially happen at earlier ages. The overall effect of this on our age-distribution plots is likely similar to the obscuring of tightly packed annuli: an underestimation of turtles in the ages between 12 and 14 years and overestimation of the 15+ class.

Age-at-maturity continued to exhibit a broader range in the Pit River than in Fall River in 2006. Habitat conditions are generally less optimal for northwestern pond turtles in the Pit River than Fall River; this is evidenced by the order-of-magnitude higher population density in Fall River Pond compared to the Pit River. Habitat in the Pit River is more variable than Fall River and includes mainstem river habitat, still backwaters, warmer isolated pools, and colder spring-fed pools. The less-than-optimal conditions of some of these habitats, including some colder water temperatures, may contribute to a more variable rate of development and age-at-maturity.

The sex ratios for individual years in the Pit River (Table 4) were fairly consistent with the Pit River composited ratio (36:36:29). The individual-year sex ratios for Fall River Pond were less consistent with the composited ratio (30:32:38). The variability of the annual sex ratios in Fall River Pond is more likely related to smaller sample sizes (i.e., number of turtles trapped) in each year, however, than a reflection of real differences. The number of turtles trapped in Fall River Pond was lower in all years than in the Pit River, which is the result of fewer trapping sites and events in Fall River Pond than the Pit River (Table 2).

Summary

After three years of monitoring, visual observations and trapping in the Study Area continue to exhibit consistent results in the distribution, habitat preferences, abundance, and demographics of the northwestern pond turtle subpopulations in the project-affected reaches of the Fall and Pit rivers. Although baseline data (i.e., from prior to the new license) are not available, the turtle subpopulations thus far appear to be stable in response to the current flow regimes, including flushing flows.

LITERATURE CITED

Ashton, D. T., A. J. Lind, and D. E. Schlick. 1997. Western Pond Turtle (*Clemmys marmorata*) Natural History. US Forest Service. Pacific Southwest Research Station. Arcata, CA. 22 pages.

BioSystems. 1985. Appendix I-B: Field maps of the study area *in* Pit 3, 4, and 5 project bald eagle and fish study. Prepared for Pacific Gas and Electric Company, Technical and Ecological Sciences by BioSystems Analysis, Inc and University of California at Davis, Department of Wildlife and Fisheries Biology 13 pages.

Bury, R. B. and D. J. Germano. 1998. Annual deposition of scute rings in the western pond turtle (*Clemmys marmorata*). Chelonian Conservation and Biology 3:108–109.

Germano, D. J. and R. B. Bury. 2001. Western pond turtles (*Clemmys marmorata*)in the central valley of California: status and population structure. Transactions of the Western Section of the Wildlife Society 37:22–36.

Holland, D. C. 1994. The western pond turtle: habitat and history. U.S. Department of Energy, Bonneville Power Administration, Portland, OR.

Jennings, M. R. and M. P. Hayes. 1994. Amphibian and reptile species of special concern in California. California Department of Fish and Game, Rancho Cordova, CA.

Spring Rivers. 2005. Northwestern Pond Turtle Protection Plan 2004 Annual Report. Prepared for Pacific Gas and Electric Company, Technical and Ecological Sciences by Spring Rivers Ecological Sciences of Cassel, California. 36 pages.

Spring Rivers. 2006. Northwestern Pond Turtle Protection Plan 2005 Annual Report, for Pacific Gas and Electric Company's Pit 1 Hydroelectric Project (FERC No. 2687). Prepared for Pacific Gas and Electric Company, Technical and Ecological Sciences by Spring Rivers Ecological Sciences of Cassel, California. 37 pages.

APPENDIX A—FERC LICENSE ARTICLES (INCLUDING CALIFORNIA WATER BOARD CONDITIONS) PERTAINING TO NORTHWESTERN POND TURTLES

Article 421. Within 6 months from license issuance, the licensee shall file, for Commission approval, a northwestern pond turtle protection plan. The plan shall determine if measures are necessary to protect northwestern pond turtles from potential adverse impacts associated with the flow regimes in California Water Board Conditions 8, 11, and 13, (Appendix); and the reduction of maximum generator loading and unloading rates required by California Water Board Condition 12 (Appendix).

The plan shall include, at a minimum:

(1) surveys for northwestern pond turtles, at a minimum, along the Pit River from its confluence with the Fall River to Lake Britton;

(2) the proposed areas to be surveyed with accompanying maps and the proposed survey methodology;

(3) a schedule for implementing the plan and for consulting with the U.S. Fish and Wildlife Service (FWS) and California Department of Fish and Game (Cal Fish and Game) and for filing monitoring reports with the consulted agencies and the Commission; and

(4) a schedule for filing any proposed protection and management measures, or any proposed modifications to the project or project operations, necessary to protect northwestern pond turtles or its critical habitat, for Commission approval.

The licensee shall prepare the plan after consultation with the FWS and Cal Fish and Game. The licensee shall include with the plan documentation of agency consultation, copies of comments and recommendations on the completed plan after it has been prepared and provided to the agencies, and specific descriptions of how the agencies' comments are accommodated by the plan. The licensee shall allow a minimum of 30 days for the agencies to comment and to make recommendations before filing the plan for Commission approval. If the licensee does not adopt a recommendation, the filing shall include the licensee's reasons, based on site-specific information.

The Commission reserves the right to require changes to the plan. The plan shall not be implemented until the licensee is notified by the Commission that the plan is approved. Upon Commission approval, the licensee shall implement the plan, including any changes required by the Commission.

California Water Board Conditions

Condition 8 requires PG&E to make continuous flow releases from the Pit 1 Forebay into the lower Fall River thence the Pit River and maintain instantaneous flows (in cubic feet per second, i.e., cfs) downstream of the Fall River Pond as measured at the Fall River Weir. The minimum required flows vary depending on the time of year, as shown below:

Dates	Required Flow (cfs)
Nov 1 through Nov 15	75
Nov 16 through May 15	50
May 16 through May 31	75
June 1 through Oct 31	150

Condition 11 requires that the combined flow of the Pit River and the Pit 1 Powerhouse during normal operations meet or exceed a daily average of 500 cfs as recorded at the U. S. Geological Service's (USGS) gage (#11-3550.10) on the Pit River below Pit #1 Powerhouse near Fall River Mills. Article 402 of the new license further increased the required total instantaneous flow in the Pit River, as measured at the same USGS gage, to 700 cfs.

Condition 12 requires that under normal operations the Pit 1 Powerhouse limit the generator-loading rate (i.e., up-ramping rate) to a maximum of 2 MW/min as a matter of public safety. This equates to a loading period of approximately 32 min. This condition also requires a generator-unloading rate (i.e., down-ramping) of approximately 0.5 MW/min to reduce the potential for stranding of aquatic organisms. This equates to an unloading period of approximately 120 min.

Condition 13 requires that PG&E release flushing flows through Fall River Pond for two consecutive weekend days three times a year for the purposes of controlling both growth of aquatic vegetation and mosquito production. Flushing flows are defined as 1,250 cfs or the natural flow to the Pit 1 Forebay, whichever is less. These flows will be released in: (1) May or June when warranted by vegetation growth in Fall River Pond, (2) July, and (3) at the end of August prior to the Labor Day weekend.

APPENDIX B—NORTHWESTERN POND TURTLE MARKING FORM

Date__________ Crew___________ Set___________ Collect_________

Survey Location (USGS Ref) ______________ T ____ R ____ S ____ Weather Conditions _____________________
Exact Site Location/Description ______________________ RK ____ RR / RL Air Temp _______ °C Time ________
Estimated Dimensions of Site ________________________________ Sun / Shade Water Temp _______ °C Time ________
Trapping / Snorkel Turbidity: High / Mod / Low Flow: Fast / Mod / Slow / Still Dom Substrate ___________________

Trap #	ID #	Sex	Carapace (mm)			R Ab med (mm)	Weight (g)			Age Est	Notes and Comments
			Length	Width	Height		Gross	Tare	Net		

APPENDIX C—SEXUAL DIMORPHIC CHARACTERISTICS

Key to sexually dimorphic characteristics in the western pond turtle (*Actinemys marmorata*) (modified from Holland 1994).

Character	Female	Male
Neck	Lateral and dorsal surfaces of the head and neck usually mottled or ocellate	Lateral and dorsal surfaces of head and neck often uniformly colored, especially in older animals
Nose	Nose relatively short, angle of nose usually vertical or near vertical	Nose relatively long, angle of nose usually 10-15 from vertical
Maxilla	Maxilla often with fine dark vertical lines or "mustache"	Maxilla lightly marked or unmarked, especially in older animals
Throat	Often flecked with numerous small dark flecks	Usually lightly marked or unmarked
Vent	Usually at or slightly posterior to posterior edge of carapace	Usually well posterior to posterior edge of carapace
Tail	Usually relatively long and thin	Usually relatively short and thick
Plastron	Area of femoral/anal seam junction usually flat	Area of femoral/anal seam junction usually slightly concave
Shell	Shell relatively high/deep in relation to length of carapace	Shell relatively low/shallow in relation to length of carapace