INTRODUCTION:

One of only two native freshwater turtles in California, the western pond turtle, *Actinemys marmorata*, is a symbol of species diversity and ecosystem health across California and here on the Mt. Tamalpais watershed. The western pond turtle is listed as ‘Vulnerable’ on the International Union for the Conservation of Nature (IUCN) Red List of Threatened Species, recognized by the California Department of Fish and Wildlife as a Species of Special Concern, and is currently under review for listing under the federal Endangered Species Act.

MMWD’s turtle observer program began as a way for volunteers to observe these reptiles around the watershed and collect valuable data on the status of native and non-native turtle populations. Volunteers complete a three-hour training session in which they learn how to identify native western pond turtles and non-native red-eared sliders, *Trachemys scripta*, as well as other non-natives. Turtle observers then use these skills to collect data about the species and behavior of turtles they observe at various lakes and trails on the watershed. Thanks to our volunteers, this is the seventh consecutive year we have been able to complete turtle surveys since 2009. The goals for the 2015 observer program were to train observers in species identification, establish population estimates for native and non-native turtles in each reservoir, and determine the proportion of native to non-native turtles. Additionally, trapping of turtles, with the aim of removing non-natives and tracking western pond turtles, was resumed for the first time since 2010, occurring in the Bullfrog Creek (a.k.a. Bon Tempe Creek) arm of Alpine Lake.
METHODS:

AmeriCorps Watershed Stewards Project members and MMWD staff facilitated training in turtle biology, species identification, and observation skills on March 7th, 2015. Once trained, volunteers could visit any of four sites on their own time until June 15th. The four locations identified for volunteers to make observations are as follows: the dam and shoreline of Lake Lagunitas, the shoreline of Alpine Lake along Bullfrog Trail, Alpine Lake below Bon Tempe Dam, and the shoreline of Phoenix Lake. These locations were chosen for their relatively high turtle activity compared to other locations on the watershed. Maps of turtle observation locations are included at the end of this report.

Volunteers observed turtles anywhere from thirty minutes to three-and-half hours at a given location. Observations were recorded on a data sheet which included the volunteer name, age, date, time interval, and weather. For each turtle sighted, volunteers were asked to record a series of qualitative observations. These observations are as follows: the observing location, whether the turtle was basking or swimming, if 1) the head was visible, 2) the turtle had a red stripe behind the eye, 3) the turtle had yellow facial stripes, 4) the throat was noticeably lighter than the face, and 5) there were yellow markings on the shell. Based upon these observations, volunteers could then classify the turtle as a western pond turtle (AM), red-eared slider (TS), unidentified non-native (NN), or an unknown species (U).

Data sheets for all locations were submitted to and compiled by WSP interns. Classifications that appeared to be inconsistent with the recorded facial and body characteristics were changed accordingly. Classifications were also verified by examining photos submitted by volunteers whenever possible. Any observations recorded at the same location on the same date were reduced to only the high count of each classification for the day. Populations for each location were estimated using the high count of each classification for that location.
RESULTS:

The annual turtle observer training was attended by 27 new recruits in 2015. Of these new volunteers, 12 submitted at least one data sheet after training, as did ten volunteers who had been trained in previous years. Participation rose by 3 volunteers in 2015 (Figure 1). Volunteers made 892 individual turtle observations, although this was less than half of the observations made in 2014. The total number of volunteer visits rose from 42 in 2014 to 63 this year (Figure 2). Volunteer observation hours fell from 106 in 2014 to 91 this year (Figure 3). In 2015 the aggregate number of turtle observations included 130 western pond turtles, 607 red-eared sliders, 75 unidentified non-natives, and 80 unknown turtles on the MMWD watershed.

Volunteers did not identify other non-native turtles by species, but these likely included Cuban sliders, *Trachemys descussa*, and river cooters, *Pseudemys concinna*, which have been verified to be present based on trapping efforts this year and in the past.

In 2012, a very high percentage of turtle observations were classified as “unknown,” constituting 222 of the 327 (68%) observations. In 2013 the importance of binocular use was heavily discussed during training, and in 2014 a spotting scope was purchased to further aid in identification. The percentage of unknown observations fell in 2013 and remained low the past two years (Figure 4).
BULLFROG TRAIL:

In Alpine Lake along Bullfrog Trail the season high count constituted 11 AM and 95 non-native turtles including 92 red-eared sliders, a slight decrease under the number of AM seen last year and a continuation of dramatic increase in the NN total and high count first observed last year (Figure 5).

This data was collected over 27 different days in 2015. The highest total turtle count, including unknowns, for a single day along Bullfrog Trail was 104 on February 13th. Early in the season return volunteers noticed a high level of activity along BFT and began to collect data. This early peak in activity was likely due to high temperatures for Mid-February. The best opportunity for observation by the entire volunteer-base was missed, for this location and probably others, possibly resulting in underestimation. It will be important to monitor for early activity like this in future seasons.
On Alpine Lake, below Bon Tempe Dam, turtle observers identified season highs of three AM and 19 NN, all of which were red-eared sliders. The 2015 numbers show a notable decrease in both NN and AM observations at Alpine Lake (Figure 7).

The highest turtle count, including unknowns, for a single day in 2015 was 23 on April 16th. The data was collected over eight different days in 2015, the fewest days of observation on record (Figure 8). The lower counts for Alpine Lake in 2015 can be attributed to fewer days of observation or possibly that early season peak activity was overlooked, in Alpine Lake and elsewhere.
LAKE LAGUNITAS:

In Lake Lagunitas, this year’s high counts by species were nine AM and 25 NN, 20 of which were red-eared sliders (Figure 9). This was a decrease from 2014 in observation numbers at this location. As with Alpine Lake, this was likely the result of fewer observation days and missed early season activity. The high count for a single day in 2015 was 33 on April 26th.

![Figure 9. Lagunitas Lake Single Day High Count By Species](image-url)

This data was collected over 11 visits in 2015 (Figure 10). Even for fewer days it can be seen that visits in March and April yielded far more observations than those that occurred in May.

![Figure 10. Lake Lagunitas Turtle Observations 2015](image-url)
Phoenix Lake:

Observers were asked to monitor Phoenix Lake starting in 2012, when turtle basking habitat was enhanced around that lake. In 2015 greater emphasis was placed on balanced coverage of locations, with Phoenix Lake being, in previous years, the most underrepresented location. In 2015, Phoenix Lake was the second most visited location.

In 2015, Phoenix Lake observers found a high count of five AM and 37 NN, all of which were red-eared sliders, representing a significant increase in TS observations over last year. A slight increase in AM should also be noted, however (Figure 11). The turtle high count on a single day in 2015 was 39 on May 22nd. This data was collected over 12 visits in 2015 (Figure 12).
DISCUSSION:

The 2015 turtle observing season can be broadly characterized as showing a high count of all species consistent with last year, a continued increase in non-native daily high counts, primarily composed of red-eared sliders, and consistently low numbers of western pond turtles.

In 2014 a number of factors were identified as having contributed to a significant increase in daily high counts. These factors included a rise in volunteer observations, many observations well-timed with peak activity periods, the purchase of a spotting scope aiding identification, as well as notable volunteer improvement in length of observation visits. It was noted that the data collected did not necessarily indicate population spikes but perhaps simply more accurate estimation. In 2015, many of these factors remained unchanged and combined turtle high counts remained essentially the same, decreasing only marginally from 209 in 2014 to 205 this year, further suggesting that accuracy may be improving.

Figure 13 illustrates that the daily high counts for all non-natives (NN) have continued to increase, from 168 in 2014 to 176 in 2015. Meanwhile the daily high count for western pond turtle decreased from 41 in 2014 to 29 in 2015. Fewer AM were observed across all locations except for Phoenix Lake which experienced higher volunteer visitation than years previous. The continued increase in non-native counts this year is significantly bolstered by the early-season high counts of TS in the area around BFT, the only location monitored during an early-season peak in activity, and less so by an increase in TS observations at Phoenix Lake. 2015 also revealed a continued growth trend for TS observations with all but one site experiencing steady increase since 2013 (Figure 14). This highlights the need for continued and improved trapping efforts.

More data will be necessary to confirm the evidence of increasing program accuracy. While methods have apparently improved, other factors that may have continued to inflate or underestimate turtle counts also need to be accounted for. The 2015 findings highlight the need for continued improvement in a number of program areas. 2015 shared similar results and participation with last year, but these figures have varied considerably in the past. This indicates 1) a need to sustain or improve upon at least the current level of participation. Additionally, observations took place for the apparent peak activity period of only one location, BFT, in 2015, yielding the season high count. This indicates 2) the need to monitor locations for peak activity over a longer observation season. Where observation visits were fewer, as with Alpine Lake, daily high counts were lower, indicating 3) the need to ensure a balanced coverage of locations.

An evaluation of last year’s suggestions and further recommendations are provided at the end of the report.
Figure 13. Native (AM) and Non-Native (NN) Turtle High Counts by Year

Figure 14. Daily High Count of Red Eared Sliders (TS)
## 2015 PROGRAM EVALUATION

<table>
<thead>
<tr>
<th>2014 Goals and Suggestions</th>
<th>2015 Outcomes</th>
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<tbody>
<tr>
<td>Find the resources and time to resume turtle trapping. The data shows a consistent</td>
<td>Trapping resumed in 2015 and took place in the Bullfrog Creek arm of Alpine Lake. Trapping success was marginal as the traps were placed after a peak activity period for the location.</td>
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<td>population of non-native turtles living on the watershed.</td>
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<td>Involve a dedicated volunteer in the turtle trapping.</td>
<td>One dedicated returning volunteer was engaged in checking the traps daily for the duration of the effort.</td>
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<td>Stress the importance of recording both a start and end time on the observer data sheets so</td>
<td>The vast majority of submitted data sheets had a recorded start and end time.</td>
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<td>an accurate number of volunteer hours can be recorded.</td>
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<td>Continue providing and insisting that the observers bring binoculars and/or the new</td>
<td>All volunteers utilized binoculars or the spotting scope during their visits; the percentage of unknown observations did not increase.</td>
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<td>spotting scope during data collection.</td>
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<tr>
<td>Enter data as it comes in and make sure that no site is under-visited. If a site is,</td>
<td>While coverage of Phoenix Lake was markedly improved in 2015, tracking of other locations was not thorough, and this allowed an imbalance in coverage to persist.</td>
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<td>make sure the volunteers know about it and encourage them to go there.</td>
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<td>Send out bi-weekly turtle docent updates; include pictures when possible.</td>
<td>Bi-weekly installments of “Turtle Tuesday!” were initiated and sent out via email regularly.</td>
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<tr>
<td>Offer the training in early March and let volunteers know that the season will end the</td>
<td>For 2015, training occurred March 7th and volunteers were given a specific deadline for data collection of June 15th. However, peak activity for 2015 seemed to occur early in the season and some data may have been missed.</td>
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<td>first weekend of June. This longer observation season leads to more data collection.</td>
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<tr>
<td>Talk to the volunteers about the difference between non-native and unknown; some of them</td>
<td>The majority of volunteers demonstrated clarity with identification, though the problem persisted with new and younger volunteers.</td>
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<td>were using this interchangeably.</td>
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<tr>
<td>Provide a guided tour of Phoenix Lake and of BFT ending at Bon Tempe Dam. One of these</td>
<td>Volunteers were given a tour and demonstration at BFT. Phoenix Lake experienced better coverage than all previous years.</td>
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<td>could be done at the initial training.</td>
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<tr>
<td>Find a way to track nesting turtles, nests, eggs, etc.</td>
<td>One non-native nest was located thanks to the help of volunteers. Unfortunately no female pond turtles were captured so tracking these turtles couldn’t be accomplished.</td>
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</tbody>
</table>
SUGGESTIONS FOR 2016 SEASON:

- Recruit at least 25 new volunteers, retain at least ten return volunteers and achieve at least 70% participation.
- Monitor weather conditions and observation locations by enlisting a dedicated volunteer early in the spring and encourage returning turtle observers to start observing prior to the observer training if turtles become active. This early monitoring can also inform when to start turtle trapping efforts.
- Track location coverage consistently and encourage volunteers to visit sites that are under-visited. Continue to utilize identification exercises during training and work towards retaining dedicated volunteers.
- Develop a sheet for the trapping volunteer to use to collect data on the turtles that are caught as well as record hours.
- Stress the importance of utilizing the spotting scope if available when volunteers arrive and encourage them to spend a length of time at one location observing.
- Remind volunteers to also record the time for any change of location during their visit.
- Track behavior, such as basking patterns across time, and habitat use, such as the use of installed habitat on Phoenix Lake, more closely. Make a new data sheet?
- Improve volunteer effort tracking to identify key metrics for improved estimates, increase overall participation and report on program success.
- Implement a survey for volunteers to identify positive and negative aspects of the program.
- Work more closely with MMWD Public Information, to continue bi-weekly e-blasts and set up Turtle Observer social media venues for information and photo sharing among volunteers and with the general public.
- Set up online data entry sheets for volunteers that wish to enter their own data.
REFERENCES


SUPPLEMENTAL TURTLE VIEWING LOCATION MAPS:

http://marinwater.org/175/Directions-Maps-to-Watershed-Sites

MMWD WATERSHED LANDS