United States Turtle Mapping Project with a Focus on the Western Pond Turtle (*Actinemys marmorata*) and the Painted Turtle (*Chrysemys picta*)

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CHAPTER 1: GENERAL INTRODUCTION

Turtles have existed for more than 220 million years, persisting through a plethora of geological and climatic changes over their evolutionary history (Kiester and Olson 2011). Their ability to survive and exploit a variety of habitats (saltwater, freshwater, and terrestrial) speaks to their past adaptive capacity, and their general resiliency to historical changes to their environments.

Turtles are slow-paced animals in regard to locomotion and reproduction rate: two attributes that contribute to their vulnerability to a variety of environmental risks. Their slow locomotive abilities often restrict them to relatively small home ranges, with sea turtles as the exception to paradigm. Freshwater and terrestrial habitats occupied by turtles are being fragmented by human development, which increases population isolation and local restriction of turtle species; local population losses can result. For example, a 20-year study demonstrated the impacts of human recreation and development on the North American Wood Turtle (*Clemmys insculpta*) (Garber and Burger 1995). The study of two populations, separated by a human-made pond, showed that when habitat was open to human recreation, turtle numbers in both populations declined significantly (Garber and Burger 1995). As agriculture and commercial land development increases, the amount of suitable habitat that turtles can occupy decreases. This is a contributing factor to the population declines of terrestrial and freshwater turtles locally, and as losses aggregate over time and space, species extinctions from portions of their range can result.

In addition to being slow-moving animals, turtles have slow reproduction rates. Their slow rate of reproduction is tied to the delayed maturation of turtles and their low survivorship as eggs and hatchlings. For example, Western Pond Turtles (*Actinemys marmorata)* mature between 5-10 years of age (Bury and Germano 2008), and these turtles are most vulnerable to risks during the egg and hatchling life stages (Vander Haegen and others 2009). Predation by native and non-native predators, including mammals, birds, amphibians and fishes, is a significant risk factor for young Western Pond Turtles (Rosenberg and others 2009). Across the Western Pond Turtle range, the Oregon Zoo, Woodland Park Zoo, and the San Diego Zoo are rearing young in captivity to sizes sufficient to escape this early predation. Head-start programs are designed to pull eggs from the wild to incubate, hatch, and rear the offspring until they reach a size that has a lower mortality rate. After ten months, the turtles are then released back into the wild to rejoin native populations (http://www.parcplace.org/images/stories/YOT/YoTNewsSeptember Turtle Spotlight: Western Pond Turtle Recovery Efforts in Full Stride in Washington and California). Vander Haegen and others (2009) found survival of larger individuals ranged from 86-97%, supporting the escape from predation that larger size can provide. The longer it takes an organism to produce viable offspring, the less resilient their populations become to quick changes in population demography and habitat. Together, both a low reproductive rate and slow locomotive abilities translate to an inability to quickly respond to environmental change or changes to their populations.

Many turtles serve important ecological functions in their ecosystems, such as being keystone predators. A trophic cascade is when a change in one species causes direct or indirect cascading effects in another species at a lower trophic level (Paine 1980). Some turtles hold valuable positions in food webs, where fluctuations in their numbers can cause cascading effects

through the system to other species. For example, the Diamond Terrapin (*Malaclemys terrapin)* and the Periwinkle Snail *(Littorina irroratta)* illustrate the importance of these food web interactions. A large portion (76-79%) of the Diamondback Terrapin's diet is made up of the salt marsh Periwinkle Snail (Tucker et al. 1995). In turn, these snails exert a top down force on the Saltmarsh Cordgrass (*Spartina alterniflora)*, decreasing grass densities with increasing snail populations (Silliman and Zieman 2001). The Diamondback Terrapin plays a vital role in the structuring of these salt marsh ecosystems.

In addition to the ecological importance of turtles, they hold a cultural significance to our society. The images of turtles have been seen as symbols of wisdom, patience, strength, and hope in many cultures (Rood 2011). For example, in the Creation Story of the Oneida tribe, a turtle is depicted as the carrier and guardian of the land we occupy (Rood 2011). They are emblems of our natural heritage, icons representing larger societal concepts, and are creatures to which we have aesthetic and emotional ties. The cultural and ecological significance of turtles makes the current decline of their populations all the more devastating. Their conservation is of paramount importance for sociological and ecological reasons.

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CHAPTER 2

MAPPING THE WESTERN POND (*ACTINEMYS MARMORATA*) AND PAINTED TURTLE (*CHRYSEMYS PICTA*) IN NORTHWESTERN NORTH AMERICA

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ABSTRACT—We compiled Western Pond Turtle (*Actinemys marmorata*) and Painted Turtle (*Chrysemys picta*) locations in northwestern North America, consolidating data from multiple sources including nine U.S. State and Canadian Provincial jurisdictions. We assessed numbers of discrete locations, and analyzed distribution patterns temporally and spatially. Western Pond Turtle observation records ranged from years 1850 to 2011 and for the Painted Turtle, from 1805 to 2011. For the Western Pond Turtle, 2,935 locations were compiled range-wide; using a 500-m buffer criterion to aggregate adjacent coordinates, we consolidated these to 2,111 discrete sites. We compiled 2,953 locations for the Painted Turtle, which consolidated to 1,219 discrete sites in the United States using the same 500-m criterion. Our occurrence maps and spatiotemporal patterns can be used to advance new efforts toward northwestern North America turtle management.

Key words: Chelonia, Conservation, Status, Distribution, Map, Historical observations, Pacific Northwest, Geographic Information Systems (GIS), Range Database

Of the 328 recognized turtle species living today, 47.6% are identified as Threatened, with 27.4% of these listed as Critically Endangered or Endangered (Turtle Taxonomy Working Group [TTWG] 2010). This threat level exceeds that of all other main vertebrate groups, with amphibians at 41%, mammals at 25%, and birds at 13% (Hoffman and others 2010). In addition, almost 20% of the recognized turtle species in the world occur in the United States, a world hotspot for turtle species diversity (Kiester and Olson 2011). The loss of turtle diversity is primarily the result of habitat loss and overexploitation for food, medicine, and the pet trade (Kiester and Olson 2011). World turtle conservation efforts are increasing to address these issues (TTWG 2010).

Conservation for species of concern relies on accurate information regarding species' distributions. For declining species, more inventory and monitoring is needed to track changes, with an initial range-wide locality compilation used to advance the prioritization of subsequent efforts. Unfortunately, this baseline information is not well documented for many US turtles. With suspected recent and potentially sudden losses in native US turtles due to over-exploitation and habitat-related disturbances (Kiester and Olson 2011), an assessment of their known distributions patterns is warranted. In 2011, Partners in Amphibian and Reptile Conservation (PARC), in collaboration with the International Union for the Conservation of Natural (IUCN) Freshwater Turtle Specialist Group, developed a list of US turtle species for which more distribution research was needed to aid in the assessment of their conservation status. This list included both rare and common species, with the list targeting species needing more attention because distributions may be changing due to habitat degradation or over-exploitation. These

species included: Diamondback Terrapin (*Malaclemys terrapin*); Red-eared Slider (*Trachemys scripta elegans*); Desert Tortoise (*Gopherus agassizii*); Texas Tortoise (*Gopherus berlandieri*); Gopher Tortoise (*Gopherus polyphemus*); Snapping Turtle (*Chelydra serpentina*); Eastern Box Turtle (*Terrapene carolina;* especially *T. c. carolina*); Ornate Box Turtle (*Terrapene ornata*); Painted Turtle (*Chrysemys picta*); Western Pond Turtle (*Actinemys marmorata*). To contribute to this effort we conducted site compilation for the Western Pond Turtle and the Painted Turtle in western North America.

The status of both Western Pond Turtles and Painted Turtles is of concern in the West. The Western Pond Turtle is ranked as globally vulnerable (G3G4) by NatureServe (www.natureserve.org; accessed 2 August 2012), and by state and province it is listed as: imperiled (S2) in Oregon (Oregon Biodiversity Information Center 2010); endangered (S1) in Washington (http://wdfw.wa.gov/ conservation/endangered; accessed March 2012); vulnerable (S3) in California (http://www.dfg.ca.gov/biogeodata/cnddb/pdfs/ spanimals.pdf; accessed July 2012); vulnerable (S3) in Nevada; and is extirpated in Canada (COSEWIC 2012). With increased urbanization, the Western Pond Turtle faces increased disturbances from humans and pets, and deaths from road traffic (Spinks and others 2003; Rosenberg and others 2009).

The Painted Turtle is similarly listed as a species of concern in some areas of the northwest, although it is ranked as globally widespread and secure (G5; www.natureserve.org; accessed 2 August 2012). It is listed as: imperiled (S2) in Oregon where it is a critically sensitive species (http://www.dfw. state.or.us/wildlife/diversity/species/docs/SSL_by_category.pdf. Accessed July 2012); apparently secure (S4S5) in Washington; apparently secure (S4) in Idaho, Montana and Wyoming; and vulnerable (S3) in Bristish Columbia, where it is considered endangered in some areas and a species of concern in other areas (British Columbia Frogwatch

Program 2011). The Painted Turtle occurs across North America, and the western form faces similar threats and disturbances to their populations as the Western Pond Turtle (Gervais and others 2009).

The goal of our study was to consolidate existing locality records of the Western Pond Turtle across its range into a comprehensive database, and initiate a similar effort for the Painted Turtle in western North America. Although each US State and Canadian Province maintains turtle locality data, a range-wide compilation has not been conducted. Through a continental campaign to compile extant distributions initiated in 2011 (http://parcplace.org/news-a-events/year-of-the-turtle.html), new data were compiled in addition to retrieval of existing institutional or personal site data. We used our newly compiled database to assess broad spatial and temporal patterns of turtle distribution. We provide an accounting of data distribution by date of first and most-recent record, along with an analysis of discrete sites by broad land ownership categories in the US. This range-wide compilation of existing information on the known locations of the Western Pond Turtle and our northwest compilation of Painted Turtle locations may inform a more strategic approach to conservation of these species.

METHODS

Locality data were compiled from institutions or agencies and several individuals. Databases were retrieved from nine organizations: Bureau of Land Management (BLM), California Department of Fish and Game (CNDDB), US Forest Service (FS), University of California at Berkeley - Museum of Vertebrate Zoology, Montana Natural Heritage Program, Oregon Biodiversity Information Center (ORBIC), Washington Department of Fish and Wildlife (WDFW), Wyoming Natural Diversity Database (WNDD), and British Columbia Ministry of the

Environment, Canada. Idaho does not maintain Painted Turtle locality data. Locality data contracts were required for databases from CNDDB, WDWS, ORBIC, WNDD, and British Columbia; these contracts restrict access to our comprehensive database. Individual site records were received from herpetologists and nature enthusiasts through PARC, and regional species experts. The 2011 Year of the Turtle campaign generated a community movement that created public awareness to promote turtle sightings (www.yearoftheturtle.org); some locality records resulted from this effort.

Data quality control and quality assurance procedures were minimal. Many data sets shared locality points. For our purpose, only one data record was needed to represent a location. Records that had the same coordinates or had duplicate attribute characteristics were identified and consolidated to one location. A comprehensive data file was generated that included location, State/Province, observation dates, and data file source using GIS ArcMap Version 9.3.1.

We examined the dates of site records to assess both the first and the most-recent observation per location. We also examined US federal land ownership of discrete sites. To define a discrete site, we chose a 500-m criterion. The distance of 500 m was used based on known movements and dispersal distances of both Western Pond Turtles and Painted Turtles (reviewed in: Rosenberg and others 2009; Gervais and others 2009). Although individuals of both turtle species can move longer distances, and are noted to move further in river systems in particular, the 500-m distance was inclusive of many movement reports, especially upland nesting forays from aquatic habitats, and was considered useful as an initial distance to segregate potentially overlapping site records. Importantly, we do not consider 500-m to be a distance to definitively distinguish turtle sub-populations. All site records within 500 m (straight-line

distance) of an adjacent record were consolidated to represent one location. The ArcMap tools "Point Distance" and "Identity" were utilized for this analysis. Counts per US federal land ownership were compiled because they may be useful to prioritize species management efforts on public lands where species conservation is a priority. GIS coverages differed for Canada, precluding a comparable analysis of Painted Turtle discrete sites and land ownership patterns. We computed area of species ranges by calculating the minimum convex polygon around discrete sites, and for the Painted Turtle, we included data records for British Columbia to provide an estimate of the northwestern range.

RESULTS

For the Western Pond Turtle, 2,935 total locality records were compiled. These locations spanned the entire range of the Western Pond Turtle from Mexico (14 sites) to Canada (1 site, extirpated). For the Painted Turtle, 2,953 site records were compiled in the northwest.

Using a 500-m buffer to consolidate adjacent locations, 2,111 discrete sites of Western Pond Turtles resulted, inclusive of sites in Canada and Mexico (Table 1). Most discrete sites were in California (56%; Table 1), and most US discrete sites were on non-federal land (71%; Table 2). For Painted Turtles, the same 500-m buffer applied to US sites only yielded 1,201 discrete sites, with the majority occurring in Montana (70%, Table 1) and on non-federal land (63%, Table 3). The geographic range of the Western Pond Turtle encompassed 646,759 km^2, which is the historical range since it includes extirpated or marginal sites in British Columbia, Oregon, and Nevada. The Painted Turtle range within the western states that we examined and British Columbia was 1,285,671 km^2.

The range of observation dates for Western Pond Turtle records spanned years 1850 to 2011. The earliest record is from 1 January 1850, reported by George Suckley in the Washington state database. The majority of first-observation efforts took place in the 1990s (Table 4). In addition, our data retrieval documented that 91 sites were revisited in the 2000s. The Painted Turtle in western North America had a broader range of observation dates, from 1805 to 2011. The first record was reported from 25 June 1805 by an undocumented observer in the Montana state database. The majority of first observation efforts for the Painted Turtle took place in the 2000s (Table 4), and only 19 sites were recorded as being revisited for this turtle.

DISCUSSION

We present the first range-wide locality maps for the Western Pond Turtle, and the first western North American locality maps for the Painted Turtle. Our breakdown of data by date and land ownership may be useful as an historical accounting for turtle surveys in the area and for development of future inventory, monitoring, or other conservation efforts.

Several data issues need to be noted. Our maps are a pictoral representation of observation efforts over the years to catalog these turtles' distributions. These records were collected by individual contributions and the cooperation of professional organizations. Because some data sources required contractual agreements not to release sensitive locality data, our maps are produced at a coarse spatial resolution and our comprehensive database cannot be shared. Additional known records are likely, especially if they have not been forwarded to the sources listed. Quality assurance procedures were limited with regard to data represented here. For our purpose, we assumed that every location represented at least one valid turtle sighting of the designated species. A secondary effort is needed to screen data for a variety of potential

errors. For example, misidentification of species, such as confusion between the Painted Turtle and the Red-eared Slider (*Trachemys scripta elegans*), may be one such error in the original data files. Unfortunately, most data records were not accompanied by a voucher specimen or photograph to screen for misidentifications.

Our comprehensive maps do not represent extant locations, nor locations of wild populations; they simply represent data acquired from the various resources which span numerous decades of animal observations, potentially including some potential releases of captive animals (not wild, native populations). Additional down-scaled analyses are needed to refine numbers of discrete sites to be more representative of actual populations. Such analyses are particularly relevant for status assessments. Holland (1993) conducted such a range assessment for Western Pond Turtle occurrences in Oregon, and reported that the species occurred at 83 of 313 (26.5%) sites he surveyed. Again, this type of site count was based on turtle observations and does not infer that populations of turtles were extant at those sites. This example of a downscaled assessment emphasizes the fact that our discrete site counts likely greatly overestimate number of turtle populations. In particular, individuals of these two species of turtles in riverine habitats are known to have greater movement distances (reviews: Rosenberg et al. 2009; Gervais et al. 2009), and hence river populations likely span greater areas and have different dynamics of dispersal and connectivity than those in pond environments.

Our discrete-sites analysis was conducted to consolidate multiple turtle observations over the years from the same local habitat unit. This type of spatial aggregation of data may provide insights for species' historical ranges and future conservation. For example, our tally of discrete sites by US federal land ownership can inform land managers of the potential protection offered to locations from known species-prioritization guidelines among ownerships. For range-wide

planning, the mix of land ownerships is apparent for potential partnership development in order to maintain contiguous populations across landscapes.

Western Pond Turtles may live >40 years (Bury and Germano 2008), and although the lifespan of the Painted Turtle is not as well documented, in the wild, Painted Turtles may live 50 years or longer (COSEWIC 2006). The presence of adult turtles can be a false indication of healthy populations, for example if recruitment of young is not occurring, yet adults are able to survive. However, a recent report found that young Western Pond Turtles are being found across the range of the species (Bury and others 2010). Given the number of data records in our comprehensively compiled effort, and recent concern of heightened 'take' of wild turtles in the US for international trade (Kiester and Olson 2011), sites might warrant revisits to assess whether a turtle population with recent reproduction is extant. In particular, sites observed before the 1970s or with an unknown observation date, may be identified as a priority for reassessment. Such sites encompass 20% of all points compiled before our discrete site analysis for Western Pond Turtles, and 13% for Painted Turtles. There are noticeable gaps in the range map that could be from fragmentation of suitable habitat or lack of data. These areas might warrant closer examination as well. For Painted Turtles, more information and data compilation needs to be done to fully represent their entire distribution across North America.

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TABLE 1. Rangewide discrete site counts for the Western Pond Turtle (*Actinemys marmorata*), and discrete site counts for the Painted Turtle (*Chrysemys picta*) within the northwestern US states. Total counts of Painted Turtle data records are presented for British Columbia, Canada. Discrete sites were compiled by adjoining data records with spatial coordinates that were within 500-m of each other in order to reduce duplication of locations.

State/ Province	No. Western Pond Turtle Sites	No. Painted Turtle Sites
Baja California, Mexico	14	0
California, US	1,191	0
Nevada, US	16	0
Oregon, US	859	120
Washington, US	30	219
British Columbia, Canada	1	268
Montana, US	0	841
Wyoming, US	0	21
Total:	**2,111 (2,096 US sites)**	**1,469 (1,201 US sites)**

TABLE 2. United States federal land ownerships of Western Pond Turtle (*Actinemys marmorata*) discrete sites based on a 500-m buffer distance. "Unique" column is the number of sites that had no other sites within a 500-m radius. The "Cluster" column is the number of discrete sites generated from clusters of sites within 500-m of each other.

Land Ownership	Unique	Clusters	Total (%)
Bureau of Land Management	89	26	115 (5.5)
Bureau of Reclamation	14	0	14 (0.7)
Department of Defense	44	7	51 (2.4)
Forest Service	301	65	366 (17.5)
U.S Fish and Wildlife Service	32	1	33 (1.6)
National Park Service	33	2	35 (1.7)
Non-Federal Land	1,341	141	1,482 (70.7)
Total	**1,854**	**242**	**2,096**

TABLE 3. United States federal land ownerships of Painted Turtle (*Chrysemys picta*) discrete sites based on a 500-m buffer distance. "Unique" column is the number of sites that had no other site within a 500-m radius. The "Cluster" column is the number of discrete sites generated from clusters of sites within 500-m of each other.

Land Ownership	Unique	Clusters	Total (%)
Bureau of Land Management	139	40	179 (14.9)
Bureau of Reclamation	3	1	4 (0.3)
Department of Defense	10	3	13 (1.1)
Forest Service	131	49	180 (15.0)
U.S Fish and Wildlife Service	49	10	59 (4.9)
National Park Service	9	2	11 (0.9)
Other	1	1	2 (0.2)
Non-Federal Land	641	112	753 (62.7)
Total	**983**	**218**	**1,201**

TABLE 4. Decade of first and most-recent observation date of the Western Pond Turtle (*Actinemys marmorata*) and the Painted Turtle (*Chrysemys picta*) for all sites in northwestern North America. Most-Recent Observation = no. sites per decade for the subset of locations for which at least two observation dates were compiled.

Decade	Western Pond Turtle		Painted Turtle	
	First Observation	*Most-Recent Observation*	*First Observation*	*Most-Recent Observation*
Unknown	299	272	200	200
<1900s	50	50	38	38
1900s	4	4	16	16
1910s	23	23	5	5
1920s	17	16	14	14
1930s	33	33	50	48
1940s	23	19	20	20
1950s	26	23	23	23
1960s	143	140	29	28
1970s	80	66	98	82
1980s	253	222	185	197
1990s	1066	1058	716	716
2000s	897	988	1402	1409
2010s	21	21	157	157
Total	**2,935**	**2,935**	**2,953**	**2,953**

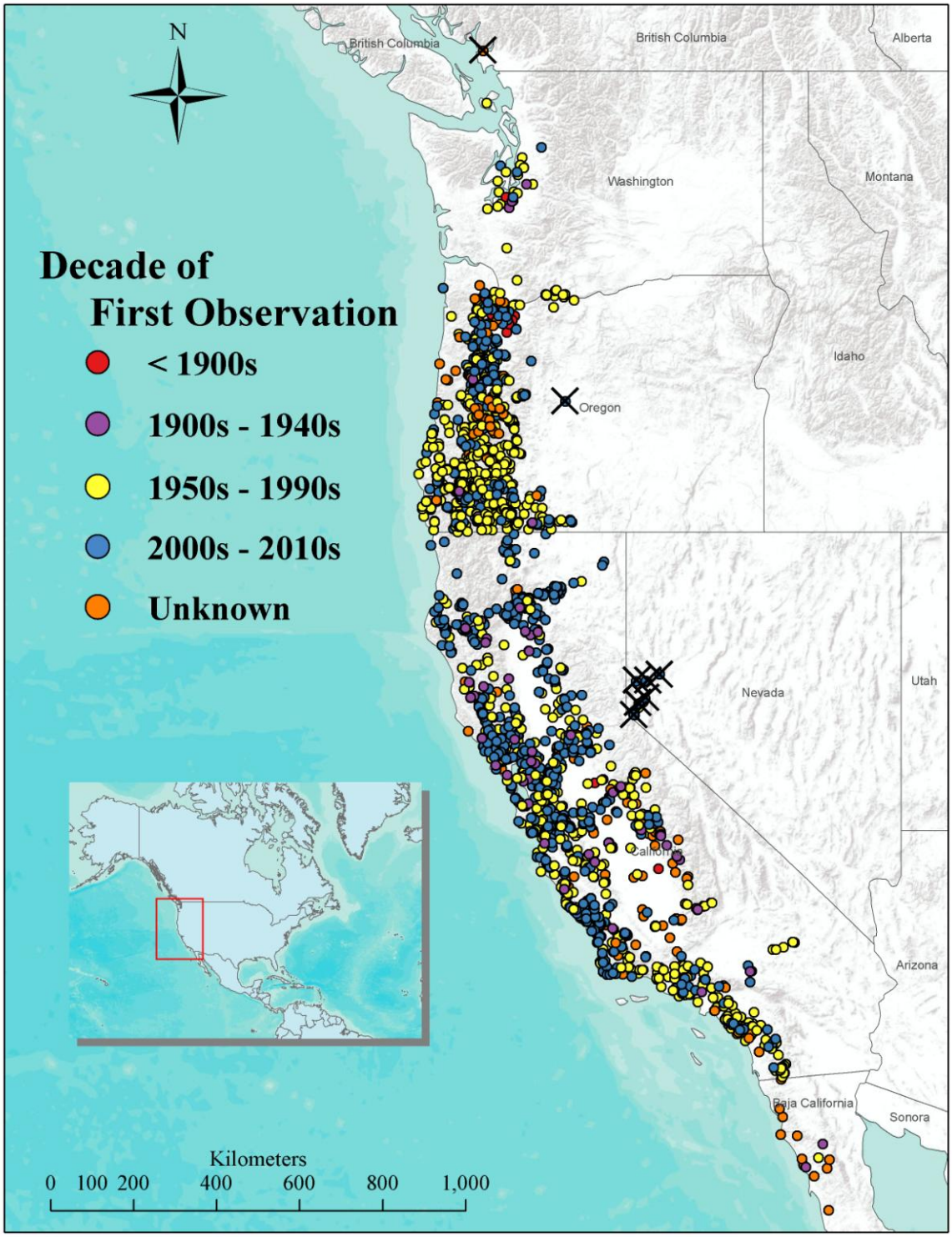

FIGURE 1. Map of comprehensively compiled data records of the Western Pond Turtle (*Actinemys marmorata*) from Mexico to Canada displayed by decade of first observation. X = extirpated or marginal sites (R. Bruce Bury, pers. commun.) N = 2,935 locations.

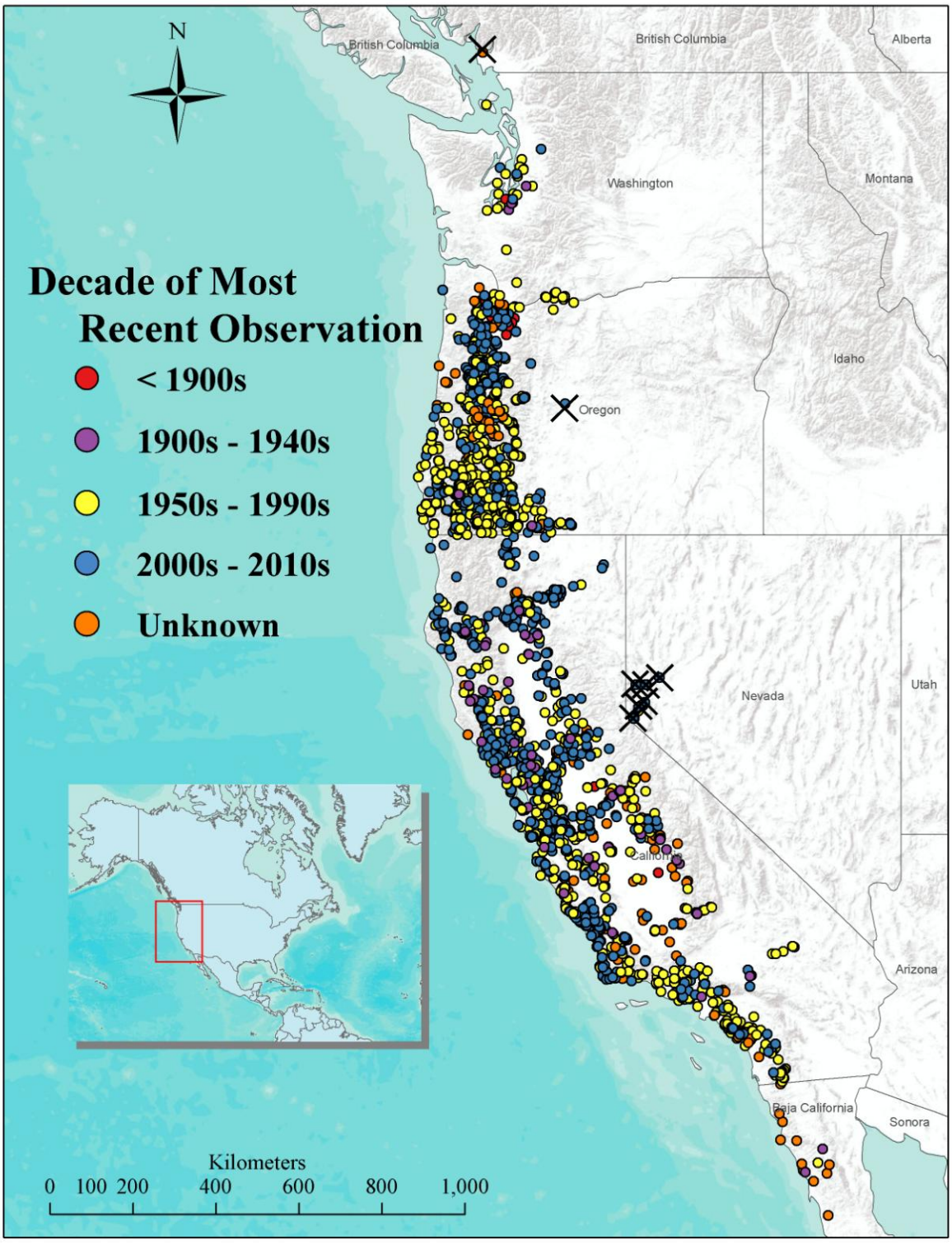

FIGURE 2. Map of comprehensively compiled data records of the Western Pond Turtle (*Actinemys marmorata*) from Mexico to Canada displayed by decade of most-recent observation. X = extirpated or marginal sites (R. Bruce Bury, pers. commun.) N = 2,935 locations.

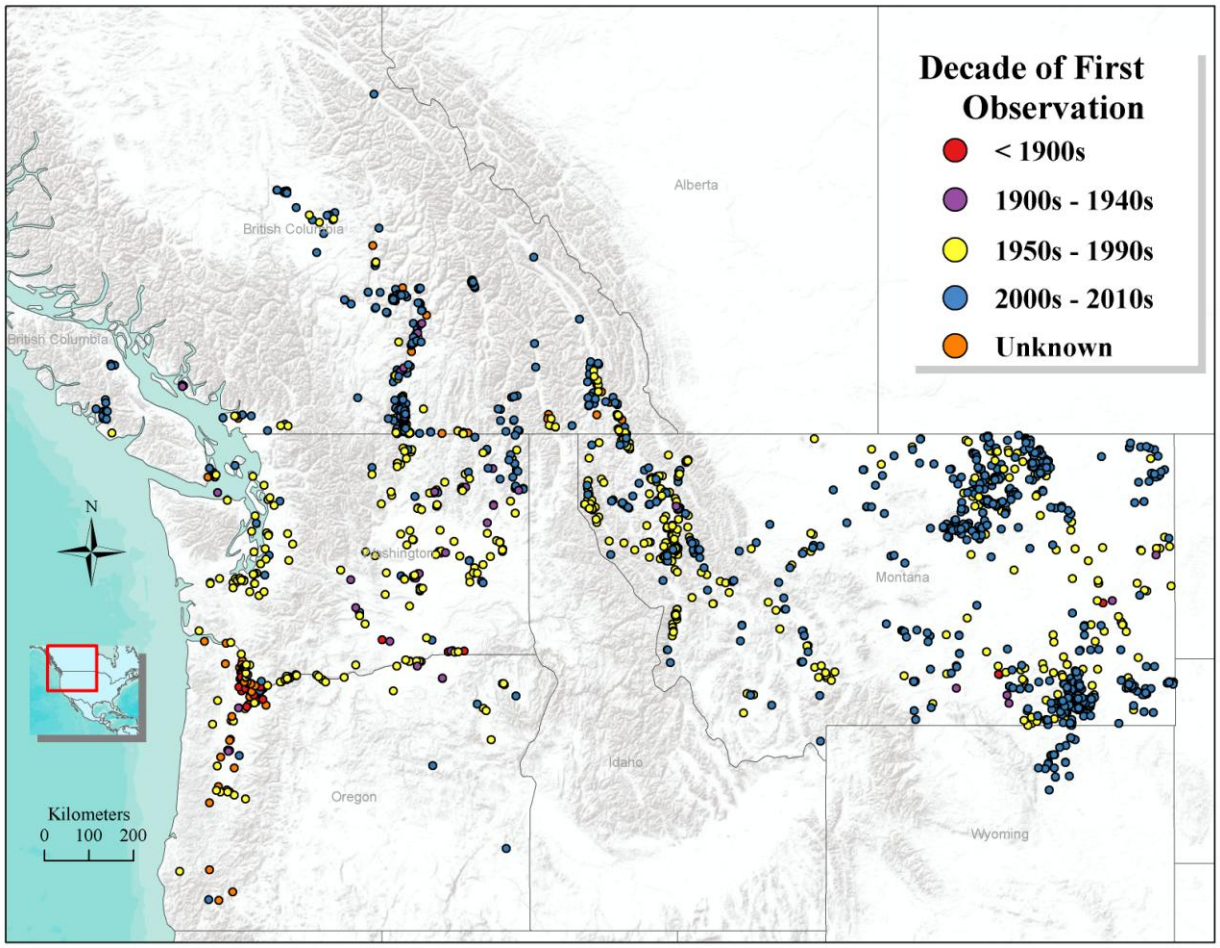

FIGURE 3. Map of comprehensively compiled localities of the Painted Turtle (*Chrysemys picta*) from Canada and northwest United States displayed by decade of first observation. N = 2,953 locations.

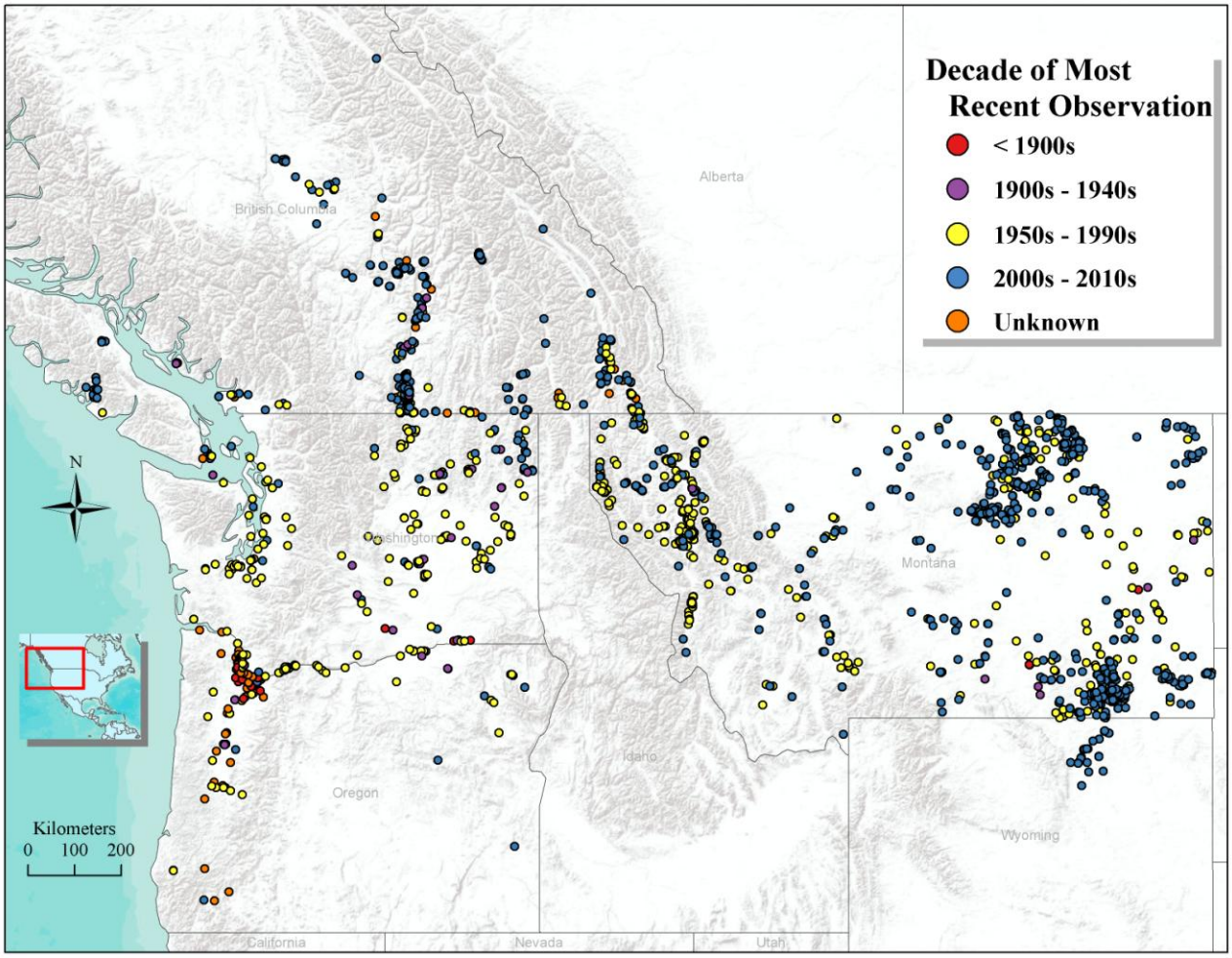

FIGURE 4. Map of comprehensively compiled localities of the Painted Turtle (*Chrysemys picta*) from Canada and northwest United States displayed by decade of most-recent observation. N = 2,953 locations.

APPENDIX A. ORGANIZATION CONTRIBUTION LIST

List of Organizations Contributing to the Northwest Turtle Mapping Project.

Data Source	Contact	Comments
British Columbia Ministry of the Environment, Canada	Amy Waterhouse, Wildlife Information Specialist, Ecosystems Information Section, Ministry of Environment, Knowledge Management Branch	Signed Agreement: K. Barela and D. Olson Data received May 2012.
Bruce Bury Data Collection	Bruce Bury, USGS Forest and Rangeland Ecosystem Science Center;	Data received April 2012
California Department of Fish and Game (CNDDB)	Brian Acord, Wildlife Biologist, California Natural Diversity Database, Department of Fish and Game; Betsy Bolster, Statewide Coordinator for Conservation of Amphibians and Reptiles, California Dept. Fish and Game	Signed Agreement: K. Barela and D. Olson Data received July 2011.
Daniel Rosenberg Data Collection	Daniel K. Rosenberg,Ph.D. Oregon Wildlife Institute and Department of Fisheries and Wildlife	Data received March 2012
GeoBob Database	Kelli Van Norman, Inventory Coordinator, Interagency Special Status/Sensitive BLM, Oregon State Office, Portland, OR	The BLM data used. Data received January 2011.
Idaho Database (No Data)	Bill Bocworth	No Data was received.
Montana Natural Heritage Program	Bryce Maxell, Senior Zoologist, Montana Natural Heritage Program, Helena, MT	Data received September 2011.
Museum of Vertebrate Zoology	http://arctos.database.museum/SpecimenSearch.cfm	Data received January 2011.
NRIS Databases	Kelli Van Norman, Inventory Coordinator, Interagency Special Status/Sensitive BLM, Oregon State Office, Portland, OR	Data received January 2011.
Oregon Biodiversity Information Center (ORBIC)	Eleanor Gaines, OR Biodiversity Information Center, Portland State University, Portland, OR. Daniel K. Rosenberg,Ph.D. Oregon Wildlife Institute and Department of Fisheries and Wildlife	Signed Agreement: K. Barela and D. Olson Data received September 2011.

APPENDIX A. CONTINUED

Data Source	Contact	Comments
PARC – 2011 Year of the Turtle campaign	Raeth J. Morgan, Biological Technician, Chesapeake Marshlands NWR Complex; Nancy M Christel, Wildlife Biologist, Department of Natural Resources; Kathleen A. Klein, Community Relations Representative, Waste Management of Michigan; James Corbett, WHC WaW Habitat Management Team Member, Callanan Industries, Inc; Mary V. Orr, Wildlife Biologist Dave Wittlinger Augustine Fucci	Data received July 2011- February 2012.
Washington Department of Fish and Wildlife (WDFW)	Lori J Salzer, WA Dept. Fish and Wildlife, Olympia, WA	Signed Agreement: K. Barela and D. Olson Data received September 2011.
Wyoming Natural Diversity Database (WNDD)	Zack Walker, State Herpetologist, WY Dept. Game and Fish	Signed Agreement: K. Barela and D. Olson Data received September 2011.

APPENDIX B. DETAILED METHODS

This document is a detailed description of the methods used to obtain, organize, and compile turtle distribution data.

Data Compilation

Databases from nine United States and Canadian organizations were obtained through contacts listed in Appendix A. For individual contributions, the PARC website and Year of the Turtle email address offered a direct communication pathway to the US Turtle Mapping Project. On the PARC website, http://parcplace.org, the organization provided three ways to document turtle sightings: an excel spreadsheet, single documented sighting via a pdf-fillable form, and a hardcopy form. Electronic submissions were sent to yearoftheturtle2011@gmail.com. Fields such as species name, date of observation, source of record, and latitude and longitude were required for any submission. It was suggested that the contributor could obtain latitude and longitude coordinates from Google Earth or similar technologies. Other fields such as accuracy, source of coordinates, country, state/ province, location description, notes, reliability of identification, likelihood of sightings, and record verification were optional and did not need to be filled out for each entry. These data forms were developed in cooperation with Peter Paul van Dijk (Freshwater Turtle Specialist Group, International Union for the Conservation of Nature).

Projection and Conversion into Geographic Information System (GIS)

Locality data were retrieved from multiple sources in the form of shapefiles, dbf files, excel files, pictures, and email descriptions. Some data files contained information on multiple turtle species; therefore relevant information was extracted and sorted into files by species. Each

species file was compiled separately so that no data from other species were transferred between files.

To provide a background and basis for data overlay, the "Topographic" template was imported from the www.arcgis.com website and used throughout the mapping and editing process so that all files could be projected onto the same coordinate system. Shapefiles imported into the data layer on ArcMap with different datum projections would trigger pop-up windows to automatically transform the data to match the projected map layer on ArcMap (the "Topographic" template). The data in the shapefiles were converted by selecting WGS_1984_5 under the "geo transformation" subcategory. This allowed all data to be altered to the same coordinate system so that comparisons could be generated on a more accurate level.

Email-received locations were imported into a Microsoft Excel format using latitude and longitude coordinates. All dbf and Excel files were converted to temporary shapefiles through the "Add XY data" tool. This tool used the longitude and latitude to create sites on the map layer via a geographic coordinate system. To map all sites, latitude and longitude was used and mapped using the WGS 1984 geographic coordinate system. These sites were then exported and saved into a file, i.e., their corresponding species file, to provide a permanent shapefile.

Coordinates of some turtle locations were estimated, in particular, locations from scanned maps sent from British Columbia, Canada (P. Govindarajulu, pers. commun.) and Baja California, Mexico (R. Bruce Bury and H.H. Welsh, pers. commun.). These locations were mapped using the "drawing" tool. The drawing tool allows the user to place sites manually. Sites were created estimating their location on the scanned map and matching that to the map layer. Each site created its own shapefile. These sites were converted into graphics and assigned a projection (WGS 1984) matching the template in order to generate latitude and longitude

coordinates through the ArcMap program. Additional data quality assurance was provided by R. Bruce Bury and H.H. Welsh for the Baja California locations (pers. commun.). Quality assurance of other data locations was not conducted. Latitude and longitude coordinates were determined for these sites and the sites were joined together to create one shapefile.

Removal of Duplicate Data

The "select by location" tool was utilized to find sites that were on top of each other or possible duplicates with projection shifts (different data sets use different datums that project onto the map layout differently). Generally, projection shifts are 10 meters apart; therefore a radius of this measure was used.

Any highlighted sites were manually compared to the sites around it. Only those that were duplicates were considered for editing. To determine which records out of the group would be deleted, a set of criteria was followed. Generally, records with the most comprehensive attribute data were retained. All deleted sites were recorded on a separate document. Sites were readily retrievable because they were cross-referenced by Object ID, Cat_ID, or FID. If an entire file was deleted, the file name was recorded as well as the reason why the file was deleted. Sites were removed using "Editor" tool that allowed a site to be selected and deleted with the delete key. This removed the site from both the map and the attribute table.

Generating a Master Excel Sheet and Shapefile

A comprehensive spreadsheet was created using Microsoft Excel 2010. Once data redundancy was addressed, all attribute tables from shapefiles were exported into dbf files and imported into a comprehensive Excel spreadsheet. Common attributes among all records included State/province name, decade, original file source, status of site, original datum, and

original projection. This Excel spreadsheet was then imported into ArcMap and made into a shapefile via the "Add XY data" tool using the WGS_1984 projection as a reference.

Analysis of Decade of Observation, Land Ownership, and Discrete Sites

When creating the master Excel spreadsheet, two columns labeled "Decade of First Observation" and "Decade of Most-Recent Observation" were created and a decade year was assigned to each site based on the date of observations. This was conducted to consolidate the sites into a chronological order according to when the site records were created. Observations collected before year 1900 were consolidated into one decade heading labeled "<1900s". This column of data was used to categorize the data in a representative manner that allowed for easier viewing of early to recent observation records. Total sites falling in each decade category was recorded and graphed in Excel.

Discrete sites were obtained by projecting the comprehensive shapefile into the Equidistant Conic Projection (from Geographic). The "Point Distance" tool with a search radius of 500 m was used to determine adjacent sites within 500 m. The unique set of site identifiers was determined from this list in excel. A dummy variable (dv) was added and the table was joined back with the comprehensive shapefile. Points where dv=1 were selected and exported to a new file. A 500-m buffer was generated for those points. These polygons were dissolved to merge overlapping polygons. Points were generated (feature to point tool) from the polygons. An Identity was done between the points and federally managed lands GIS layer. This table was exported to a .dbf and pivot table using agbur and count in excel. Agbur is the name of the attribute category that contains the codes "BLM, USFS, etc." The category "count" was created and populated by 1's to obtain a count of points within each landownership category in agbur.

The sites that were not within 500 m of another site were exported to their own layer and an Identity done with the federally managed lands layer. This table was exported to a .dbf and pivot table done on agbur and count. The result of the two pivot tables were combined into one table (Kelly Christiansen, GIS analyst, US Forest Service, pers. commun

APPENDIX C. SOURCES OF LOCATIONS BEFORE AND AFTER DATA COMPILATION

Breakdown of locations contributed to the United States Turtle Mapping Project and the final comprehensive data files for Western Pond Turtle and Painted Turtle by source.

Source of Data	Western Pond Turtle Locations		Painted Turtle Locations	
	Original File	*Comprehensive File*	*Original File*	*Comprehensive File*
British Columbia	1	1	1390	1135
Bruce Bury	48	48	-	-
CNDDB	1134	1131	-	-
Daniel Rosenberg	2	2	13	13
GeoBob Database	356	0	3	0
Montana Natural Heritage Program	-	-	1239	1239
Museum of Vertebrate Zoology	602	413	4	3
NRIS Databases	438	297	5	5
ORBIC	1833	994	361	243
PARC	16	16	39	22
WDFW	51	51	274	274
WNDD	-	-	41	41
Total	**4,470**	**2,935**	**3,369**	**2,975**

APPENDIX D. RECORD OF DUPLICATED SITES REMOVED FOR THE WESTERN POND TURTLE

Records were edited based on location of sites. If two sites occupied the same coordinates or retained the same attribute data, then the site with dates of observation or a more comprehensive attribute set were retained in the comprehensive database, and the other site record was removed. Tables D.1-D.2 document observation records removed from the different data sources for the Western Pond Turtle.

TABLE D.1. Removal of Full Files for Western Pond Turtle (*Actinemys marmorata)*

File Removed	Source of File	Reason For Removal
GB_FAUNA_OBS	BLMGeoBOB Data	All were the same as data in Museum of Vertebrate Zoology; (Object ID:249940 was not directly duplicated in museum data but it is right on top of others in the same data file)
GB_Fauna_SITES	BLMGeoBOB Data	All were the same as data in Museum of Vertebrate Zoology; Except for one in GB_FAUNA_OBS (in ORBIC)
RRS_turtle_obs_pt.shp	ORBIC	All were the same as data in Fishwildlife_Observations (FS_NRIS) except for object ID 4117. RRS_turtle_obs_pt had no dates so points in FS_NRIS points were kept instead.
FreWin_turtle_obs_poly	ORBIC	All were the same as data in Fishwildlife_Observations (FS_NRIS)
UMP_turtle_obs_poly	ORBIC	All were the same as data in Fishwildlife_Observations (FS_NRIS)
UMP_turtle_site_poly	ORBIC	All were the same as data in Wildlife sites(FS_NRIS)
off_mf_pond_turtle_obs	ORBIC	All were the same as data in WIL_turtle_obs_pt (ORBIC)
UMP_turtle_site_pt	ORBIC	All points were the same as data in Wildlife sites (FS-NRIS). Wildlife sites data had more date information.

TABLE D.2. Site Removals for Western Pond Turtle (*Actinemys marmorata)* Based on Object ID Unless Otherwise Stated.

File Sites Removed From (Source of File)	File Sites Were Compared To (Source of File)	Sites Removed
Fishwildlife_Observation (FS NRIS Data)	CRG_MTH_turtle_obs_pt.shp (ORBIC)	1090937, 1094676, 1094718, 1095183-84, 1095631, 1095706, 1096237-39, 1096245, 1098106, 1098108
	FreWin_turtle_obs_pt.shp (ORBIC)	1047766, 1049024, 1049167, 1049244, 1052434, 1052553
	ORNHIC turtles points (ORBIC)	1113885, 1113922, 1178414, 1179381
	WIL_turtle_data (ORBIC)	1211515, 1215548
	UMP_turtle_obs_pt.shp (ORBIC)	1178474, 1178504
	RRS_turtle_obs_pt (ORBIC)	1102284
	RRS_turtle_sites_pt (ORBIC)	1178473
	Wildlife sites (FS NRIS Data)	138113-15, 139126, 139127, 152813, 471799, 506401, 1178614, 1178620, 1178628, 1178655, 1178656 1178661, 1179020, 1179023-25, 1179041, 1179043, 1179054, 1179060, 1179062, 1179066-69, 1179071, 1179073, 1179075, 1179078, 1179094, 1179095, 1179101, 1179264-75, 1179310, 1179311, 1179384-86, 1179430-41, 1179454, 1179456-59, 1179461, 1179462, 1179464-66, 1179468, 1179596-05, 1179614-16, 1181646
Wildlife sites (FS NRIS Data)	Wildlife sites (FS NRIS Data)	136645, 163659-65, 175735, 175737
	CRG_MTH_turtle_sites_pt.shp (ORBIC)	71750, 71751
	FreWin_turtle_site_pt.shp (ORBIC)	3853, 3836, 3837
	RRS_turtle_site_pt.shp (ORBIC)	166593
	WIL_turtle_site_pt (ORBIC)	178340-178359, 178402, 178403
UMP_turtle_obs_pt.shp (ORBIC)	Wildlife sites (FS NRIS Data)	44

APPENDIX D. CONTINUED

File Sites Removed From (Source of File)	File Sites Were Compared To (Source of File)	Sites Removed
	Fishwildlife_Observation (FS NRIS Data)	45, 189, 207, 219, 233, 258, 294, 346, 424-5, 451, 491, 496, 498, 500, 502-04, 510, 537-38, 540, 543, 552, 555-57, 560-62, 567, 573, 583, 586, 590-600, 604, 606, 608, 611-14, 616, 618, 625, 627-28, 631, 633-50, 652-55, 658, 663-66, 669, 672-74, 679, 717, 730-33, 745, 755, 770, 774, 857, 861, 865, 898, 903, 907, 916, 918, 923-24, 929, 940, 943, 966, 968, 985-86, 1001, 1017, 1023-32, 1035, 1037,1044, 1046, 1056-68, 1084, 1087-89, 1092, 1131, 1133-45, 1147, 1157-71, 1200, 1201, 1501-03
GB_FAUNA_SITES (ORBIC)	GB_FAUNA_OBS (ORBIC)	1-48, 50-53
CRG_MTH_turtle_obs_pt (ORBIC)	ORNHIC Turtle Points (ORBIC)	4537-38
ODFW_ASSESSMENTRESPONSESMarch2009_WGS84_10N.csv (ORBIC)	'Zone 10T$' (ORBIC)	1-2, 6-7, 10, 12, 17, 21-23, 26, 30, 32-33, 35-36, 40, 42, 47, 49-52, 55, 58, 60, 64-66, 68-69, 71-75, 77, 79, 81-82, 84-85, 88-89, 91,93, 97, 99, 101, 105-09, 112-13, 115-17,119-20, 122, 125-28, 131-32, 135-36, 140-41, 145, 147-48, 152-56, 160, 162-64, 166, 170-72, 175-76, 178-79, 185-87
GB_FAUNA_OBS (ORBIC)	ORNHIC Turtle Points (ORBIC)	9, 153, 253, 264, 270, 273, 275, 278-9, 286, 289

APPENDIX D. CONTINUED

File Sites Removed From (Source of File)	File Sites Were Compared To (Source of File)	Sites Removed
	Museum_of_Vertebrate_Zoology_Berkeley	3, 5-7, 10, 15, 16, 18-24, 28, 31-34, 36, 43-46, 48, 50-53, 57-59, 61, 68-70, 72, 74, 75, 77, 78, 81, 83, 84, 90, 91, 93, 96, 99, 100, 102-106, 108, 109, 111-114, 116, 117, 120, 123, 127, 133, 135, 137-141, 144, 145, 149, 151, 152, 156, 160, 162, 163, 14, 29, 37, 60, 87, 115, 290, 1, 11-13, 17, 38, 40, 42, 49, 63, 64, 80, 85, 88, 95, 126, 130, 131, 142, 146, 150, 159, 4, 25, 76, 179, 260, 271, 283, 197, 71, 206, 208, 265, 207, 199, 200, 183, 189, 190, 187, 267, 192, 191, 195, 188, 293, 196, 259, 136, 172, 178, 181, 184, 194, 198, 254, 257, 261, 262, 266, 269, 291, 294, 2, 41, 54, 66, 79, 92, 110, 119, 122, 282, 284, 177, 186, 281, 8, 30, 39, 47, 62, 82, 97, 107, 132, 134, 158, 161, 174, 258, 272, 118, 148, 173, 180, 263, 128, 255, 169, 170, 129, 164, 26, 27, 35, 55, 65, 67, 73, 86, 89, 94, 98, 101, 124, 125, 147, 154, 155, 185, 202 -205, 241, 252, 256, 268, 274, 276, 277, 280, 285, 287, 165, 56, 121, 143, 193, 201, 244-249, 288, 167, 168, 171, 175, 176, 209-240, 242, 243
CNDDB	CNDDB	599, 601, 1217
Museum_of_Vertebrate_ Zoology_Berkeley	ORNHIC Turtle Points (ORBIC)	CAT_OBs: 145448, 147401, 154872, 160627, 162763, 163182, 166778, 166953, 174998, 180742, 182281, 182590, 245592
turtles_applegarth_final.shp (ORBIC)	turtles_applegarth_final.shp (ORBIC)	No Identifying Cateragory. 194 sites deleted.

APPENDIX E. RECORD OF DUPLICATED SITES REMOVED FOR THE PAINTED TURTLE

Records were edited based on location of sites. If two sites occupied the same coordinates or retained the same attribute data, then the site with dates of observation or a more comprehensive attribute set were retained in the comprehensive database, and the other site record was removed. Tables E.1-E.2 document observation records removed from the different data sources for the Painted Turtle in the northwest.

TABLE E.1. Removal of Full Files for Painted Turtle (*Chrysemys picta)*

File Removed	Source of File	Reason For Removal
GB_Fauna_SITES	BLMGeoBOB Data	All were the same as data in GB_FAUNA_OBS (BLM Data).
GB_FAUNA_OBS_DKR_edit_Zone10N_Paintedturtle.csv	ORBIC	Deleted because same was in GB_FAUNA_OBS_DKR_edit.csv(ORBIC)
GB_FAUNA_OBS_DKR_edit_Zone11N_Paintedturtle.csv	ORBIC	Deleted because same data was in GB_FAUNA_OBS_DKR_edit.csv(ORBIC)
GB_FAUNA_OBS$ (GB_FAUNA_OBS_DKR_edit.xls)	ORBIC	Deleted because same data was in GB_FAUNA_OBS (2009_1_7_GeoBOB_turtle.mdb;ORBIC)
GB_FAUNA_OBS (GB_FAUNA_OBS_DKR_edit.xls)	ORBIC	Deleted because same data was in GB_FAUNA_OBS (2009_1_7_GeoBOB_turtle.mdb;ORBIC)
GB_FAUNA_OBS_DKR_edit.csv	ORBIC	Deleted because same data was in GB_FAUNA_OBS (2009_1_7_GeoBOB_turtle.mdb;ORBIC)
GB_FAUNA_OBS$ (GB_FAUNA_OBS.XLS)	ORBIC	Deleted because same data was in GB_FAUNA_OBS (2009_1_7_GeoBOB_turtle.mdb;ORBIC)
GB_FAUNA_OBS (GB_FAUNA_OBS.XLS)	ORBIC	Deleted because same data was in GB_FAUNA_OBS (2009_1_7_GeoBOB_turtle.mdb;ORBIC)
ORNHIC_turtles_points.shp (ORNHIC_turtles_received feb 1 2009/)	ORBIC	Deleted because same data was in ORNHIC turtles points (Turtle Polygons ORNHIC 2009; ORBIC)
ODFW_ASSESSMENTRESPONSESMarch2009_WGS84_11N.csv	ORBIC	Deleted because same data was in ODFW_ASSESSMENTRESPONSESMarch2009_WGS84_10N.csv (ORBIC)

APPENDIX E. CONTINUED

File Removed	Source of File	Reason For Removal
GB_FAUNA_OBS	BLM GeoBOB	Deleted because same data was in GB_FAUNA_OBS (2009_1_7_GeoBOB_turtle.mdb;ORBIC)
RRS_turtle_site_pt.shp	ORBIC	All were the same as data in Fishwildlife_Observations (FS_NRIS)

APPENDIX E. CONTINUED

TABLE E.2. Site Removals for Painted Turtle (*Chrysemys picta)* Based on Object ID Unless Otherwise Stated.

File Sites Removed From (Source of File)	File Sites Were Compared To (Source of File)	Sites Removed
Survey_obs_chelonia (British Columbia)	Incidental_obs_chelonia (British Columbia)	4387188-90, 4387193-94, 4387196, 4387248-51, 4387316-24, 4387376-82, 4387385-87, 4387441-47, 4506374-75, 4506379, 4506968-69, 4507240-41, 4507361-62, 4507389, 4507402, 4507652, 4507762, 4507781, 4507889, 4508343-44, 4508472, 4573222-23, 4573357-60, 4573362-64, 4573366, 4573500-08, 4573646-53, 4573796-98, 4573800-01, 4573804, 4573945, 4750383, 4750409-19, 4750445, 4750454-59, 4750483-84, 4750487-90, 4750494, 4750522, 4750524-28, 4750533-34, 4750736-38, 4750754-56, 4750824, 4750861, 4750863, 4751237, 4751395-96, 4751448, 4751482, 4751508-09, 4751554, 4751570-71, 4751611-12, 4751628-30, 4772062, 4772150-54, 4772239-51, 4772335-36, 4772448, 4772537, 4772539-41, 4772628, 4772630-31, 4772711, 4772721-23, 4772889-91, 4773057, 4773143, 4773154, 4773156, 4773230, 4773325, 4773326
GB_FAUNA_OBS	ORNHIC Turtle Points (ORBIC)	251
CHRPIC pts June 22 2009 (ORBIC)	ORNHIC Turtle Points (ORBIC)	642, 777, 1598, 1610, 2665, 3121, 3358, 5216, 6809, 6999, 8324, 9282, 10282, 10663, 10971, 11175, 11594, 12622, 13111, 13815, 14298, 14898, 15386, 15725, 16490, 16491, 16948, 18224, 18589, 18920, 19702, 19865, 21170, 21445, 21945, 22564, 22568, 22951, 42711
ODFW_ASSESSMENT RESPONSESMarch2009_WGS84_10N.csv	‘Zone 10T$’ (ORBIC)	32, 35

APPENDIX E. CONTINUED

File Sites Removed From (Source of File)	File Sites Were Compared To (Source of File)	Sites Removed
Incidental_obs_chelonia (British Columbia)	Incidental_obs_chelonia (British Columbia)	1467459, 1467559, 1467561-62, 1468529, 1468541, 1468880, 1468884, 1468889, 1468971, 1468973-74, 1468976, 1469001, 1469076-77, 1469079, 1469082, 1469090, 1469095, 1469100, 1469185, 1469201, 1469290-92, 1469297, 1469307, 1469684, 1469705, 1469711, 1469808, 1469815, 1469902, 1469904, 1469907, 1469910, 1470000-02, 1470005, 1470008, 1470017, 1470119, 1470121, 1470123, 1470127, 1470131, 1470228, 1470230, 1470232, 1470242-44, 1470336, 1470340, 1470347, 1470351, 1470355, 1470358, 1470453, 1470458, 1470460, 1470486
GB_FAUNA_OBS (BLM GeoBOB Data)	ORNHIC Turtle Points (ORBIC)	220486
ORNHIC Turtle Points (ORBIC)	Wildlife sites (FS NRIS Data)	Feature ID: 24399, 26001
ORNHIC Turtle Points (ORBIC)	Museum_of_Vertebrate_Zoology_Berkeley	Feature ID: 80936
Museum_of_Vertebrate_Zoology_Berkeley	Museum_of_Vertebrate_Zoology_Berkeley	CAT_OBs: 16857, 16858
Year of the Turtle	Year of the Turtle	17 sites were removed based on same coordinates as others in the same dataset.

APPENDIX F. ATTRIBUTE DEFINITIONS

The following is a list of definitions for each attribute category in the data set. Definitions were obtained through the metadata of the original datasets. Some categories were not defined but still retained in the comprehensive excel file to ensure no important information was removed for a site.

TABLE F.1. List of Attribute Categories with Recorded Definitions

Attribute Category	Definition
Adult Females	Number of adult females observed
Adult Males	Number of adult males observed
Adult Unknown	Number of adult of unknown sex.
ASSOC_OBS	Number of observations associated to this site
ASSOC_SITE	Number of sites associated to this site
ASSOC_SURV	Number of surveys associated to this site
ASSOC_VISI	Number of visits associated to this site
BA_SOURCE	Identifies Business Area application from which record
BioticInfo	Concatenation of information from bioticobs table
Class Name: FAOBS_SP_1, TAXONOMIC, TaxoClass, Elem_type	Taxonomic Class
CLASS_ENGL	Class name in English
CMN_VST_CN	Unique identifier that relates an observation to a Site Visit. If null, observation is incidental.
Collection:FAOBS_DATA, FASITE_ADM, FASITE_DAT	The administrative Unit that the Site exists on, or collection it is from.
Common Name: Common_Name, CNAME, SCOMNAME, GCOMNAME, FAOBS_COMM	The common name of the animal.
Country	The country in which the locations reside. (created by Kim
County	County on which the site resides.

Appendix F. Continued

Attribute Category	Definition
Data_Source: SOURCE	An alphanumeric code designating the source of a database record. Identifies Business Area application from which record originated.The original source of the site, if migrated.
Date Accuracy: Accuracy DATE_TIME1, ESTABLISH1, Date Accur, FAOBS DA 1	Accuracy of the date/time of the Observation. Wildlife data only.
Decade of First Observation	Decade in which the First Observations was recorded. (Created by Kim Barela)
Decade of Recent Observations	Decade in which the Most-Recent Observation was recorded. (Created by Kim Barela)
DelormePag: Delorme	Page Number of Delorme Map Atlas
Direction	Direction to site
Eggs	Number of eggs observed.
ELCODE: ELMCODE	Element code assigned to species or vegetation community by NatureServe, consisting of a 10-character structure depicted on website.;ORBIC-ORNHIC-1st and 2nd byte (PD=Plant dicot, PM=Plant monocot, PG=Plant gymnosperm, PP=Plant pteridophyte, AA=amphibian, AB=bird, AF=fish, AM=mammal, AR=reptile, I=invertebrate. 3rd-5th byte (family abbreviation). 6th-7th (genus code). 8th-9th (species). 10th (tie
EO_ID	Unique identification number for Element Occurrence records.
EO_NUM	Unique element occurrence record number for a given species or vegetation community.
EO_RANK	Viability rank for the occurrence.
EOCODE	Unique location identifier composed of the Elcode (see separate definition) and the EO_num, which is a unique number for that species and usually but not necessarily sequential.
Family_Nam	Family name of animal.
FAOBS_ABUN	An assessment of how abundant the species is.
FAOBS_CN	Required. Species observation primary key Control Number.
FAOBS_DIST	The spatial distribution of individual plants at an Observation
FAOBS_ID	A user-defined identifier for the Observation record.

Appendix F. Continued

Attribute Category	Definition
FAOBS_LOCA: FASITE_LOC	Describes the precision with which the recorded UTMs or lat/longs and the associated GIS digitized (electronic) point or polygon matches the actual ground site location. Refer to Look-up Table located at GEOBOB_GB_MAP_ACCURACY_LU for list of values.
FAOBS_MIGR	Field to track the source of data migrated into GeoBOB.
FAOBS_MODI: FASITE_MOD	Name of user that last modified record. Automatically populated display field.
FASITE_CUR	Flag that denotes if the site is current or historical (1 - Current, 2 - Historical).
FASITE_ID	User defined site ID.
FASITE_SUB	The sub administrative Unit that Site exits on
FASITE_UNI	Auto populated by application when polygon is digitized. In
FASITE_V_2	The purpose of the visit to the site.
FEATURE_ID	Unique identification number for the shape (original point, line, or polygon).
FED_STATUS	Federal designations assigned to individual species for legal purposes under the Endangered Species Act. From NRIS Taxa. Please note that the data in this field are dependent on FS units having entered status information into the NRIS TAXA application. A null value does not necessarily indicate an unlisted status.
Female	Number of Females observed.
FIELD_LOCA	The estimated or known maximum distance in meters the actual point could be from the GIS feature.
First observation: Observation_Date, survey_obs, establish, VERBATIM_D, FIRST_OBS, FAOBS_DATE, effort_date, OBSERVATION	Date of First observation of the site.

Appendix F. Continued

Attribute Category	Definition
FS_STATUS	The Forest Service designations assigned to individual species for legal and policy purposes. From NRIS Taxa. Field is concatenated if multiple designations occur. Please note that the data in this field are dependent on FS units having entered status information into the NRIS TAXA application. A null value does not necessarily indicate an unlisted status.
FS_Unit_ID	Identifier of Forest Service unit that stewards the data.
FS_UNIT_NA	The name of the Forest Service unit that stewards the data.
GLOBAL_RAN: GRANK	Global Heritage Rank
Group	Identification Code for Date range of observation provided by Kelly Christiansen
Group Type	Description of the size and relationship of the animal group observed
Habitat:HABITATDES,	Habitat description
ID_CONFIRM	Identification Confirmed: Y=Yes, identification of species is confirmed, to the best of our knowledge; ?=identification is questionable
Juvenile Females	Number of juvenile females observed.
Juvenile Males	Number of juvenile males observed.
Juvenile	Number of Juveniles observed
Juvenile Unknown	Number of unknown juveniles observed.
Last_Updat	Date of last modification to record in this feature class
Last Visit 1	The date/time the latest visit to the site ended.
LAST_VIS_2	Accuracy of the last visit date/time.
LAST_VIS_3	The status of the site at the time of the most-recent visit.
LAST_VIS_4	Condition of the site at the time of the most-recent visit (Usable, Unusable)
LAST_VIS_5	The use of the site by an animal at the time of the most-recent visit. For biological sites only.
LAST_VISIT	The date/time the latest visit to the site started.
Latitude: Lat_SPNAD8, FAOBS_LAT_	The Latitude of the site.

Appendix F. Continued

Attribute Category	Definition
Likelihood	A measure of the likelihood of observing this species at this
List	All rare species in Oregon are assigned a list number of 1, 2, 3 or 4, where 1=threatened or endangered throughout range, 2=threatened or endangered in Oregon but more common elsewhere, 3=Review List (more information is needed), 4=Watch List (currently stable). An "-ex" means extirpated from the state, an "-X" means presumed extinct.
Local ID	Local identifier assigned by user to link record to external data sources. Wildlife data only
Location: SPEC_LOCAL, SURVEY_SIT, Loc_notes, LOC COMMEN	Notes on Location
Longitude: Long_SPNAD, FAOBS_LONG	The Longitude of the site
Male	Number of Males observed.
MAPPEDBY	Person who created the shape
MAPPEDDATE: FAOBS_CR_1, FASITE_C_1	Date shape created
MOD_by: FAOBS_CREA, FASITE_CRE	Name of the user that created the record. Automatically populated display field.
MOD_DATE: MODIFIED_D, FASITE_M_1	Date the record was last modified. Automatically populated display field.
NATURESERV	The conservation status of a species or community designated by combination codes of two-to-four characters that identify the appropriate geographic scale, degree of imperilment, and other relevant factors. From NRIS Taxa. Please note that the data in this field are dependent on FS units having entered status information into the NRIS TAXA application. A null value does not necessarily indicate an unlisted status.
Nests	Number of nests observed
NEXT_VISIT	Anticipated date of next visit
Notes: Comments, OccurNotes, MISC_COMME, NOTES, GENCOM, OBS_Data	Occurrence notes and comments.

Appendix F. Continued

Attribute Category	Definition
Object ID	A unique feature number automatically generated by the
OBS_ADDR	Observer's Address
OBS_CN	Unique ID generated by the NRIS application for the
OBS_EMAIL	Observer's Email
OBS_METH_1	Description of the method used to detect the animal.
OBS_METH_2	Description of the method used to detect the animal.
OBS_METHOD: method	Method by which the animal was observed.
OBS_PHONE	Observer's Phone
OBS_TYPE: FAOBS_TYPE	Type of detection by which species presence was determined.
Observer: ObsAffil, originator, SHORT_REFE, OBS_NAME FAOBS OBSE.	Name of Observer or observers
ObsID	Unique identification number for the Observation
OccurClass	Biological classification of the occurence.
OccurPoint	A unique feature number automatically generated by the geodatabase for each OccurPointID in the table.
OccurTyp: Occ Type	The biological entity that is being observed (Nest, communal roost
ORDER_NAME	Name of the Order
ORIGIN	Origin of site (Natural, Artificial). Applies to biological sites
ORIGIN_MET	How the site was discovered. Applies to biological sites only.
Original File Name	Original name of the file the points were extracted from.
Original Folder	Original Folder name of the Organization the data was
Original Latitude Form	Original form of Latitude coordinates, sometimes in degrees.
Original Longitude Form	Original form of Longitude coordinates, sometimes in
Pairs	Number of pairs observed
PATU	Number of PATU turtles seen
Phylum Name	Phylum Name

Appendix F. Continued

Attribute Category	Definition
PHYSPROV	CR=Coast Range, WV=Willamette Valley, KM=Klamath Mountains, WC=West slope and crest of the Cascades, EC=East slope of the Cascades, BM=Ochoco, Blue and Wallowa Mts., BR=Basin and Range, CB=Columbia Basin, SP=Snake River Plains. Note: the 'old' province of
POD_index:Link2	Sequential unique whole numbers that are automatically
Point ID	ID number created by Kimberly Barela to match each point
Point Status	Status of the Point
POND	Number of Pond Turtles Seen
Project Name	Name of project
PROJECT_EN	Project end date
Project_St	Project start date
Protocol_N	Name of the survey or data collection protocol. Aquatic Surveys
PT_RES	Number of Painted or Red ear Slider Turtles seen
Recent Observation	Most-Recent (or latest) observation date recorded for the site.
Reference	Primary reference fort the record
Reliability: FAOBS_RELI	A ranking of how reliable the Observation record is, based on the
Repro Status	Reproductive status of the animal observed
RESL	Number of RESL turtles seen.
Scientific Name: Scientific_Name, SNAME, FAOBS_SCIE, SCIENTIFIC	The scientific name used by each file.
Sensitive	Is it sensitive. Y or N.
Sex	Sex of the observed turtle
SHAPE_Area	Geometry (spatial data) for the record.
SHAPE_ID	Unique identifying number for each shape in ArcView shape file, computer generated number
SHAPE_Leng	Geometry (spatial data) for the record.
SHAPE_STAT	Indication of the site's spatial characteristics.

Appendix F. Continued

Attribute Category	Definition
Site Name	Site Name
SITE_CATEG	Primary classification of site with respect to biological meaning. (Required)
SITE_CN: FASITE_CN	The primary key control number of the related Fauna. The unique system generated identifier for the site. This identifier persists for the life of the site.
SITE_TYPE	Sub classification of site category. (Required)
SNAPPER	Number of SNAPPER turtles seen
SOURCE_GEO: FTYPE, ORIG_SHAPE	The geometry type of the feature in the source feature class. Point and Line features were buffered by 10 meters to create a polygon feature.
Source_o_1	Device or mapped source of location coordinates
SPATIAL_ID	Unique spatial ID generated by the NRIS application for a survey or observation location.
Species Code: SPPCODE, Species_Co, FAOBS_SPEC, FASITE_SPE	Standard species code derived from genus and species. The species code of the species recorded as an Observation.
SPECIES_1: species	Species sighted
SPECIES_2	Second species possibly sighted.
Stage: Life Stage	Stage animal is in.
State: Province	The State or Province in which the point resides. (Created by Kimberly Barela)
STATE_RANK: SRANK, PROVINCIAL	State Heritage Rank
STATE_STAT	State designation assigned to individual species with conservation concern. From NRIS Taxa. Please note that the data in this field are dependent on FS units having entered status information into the NRIS TAXA application. A null value does not necessarily indicate an unlisted status.
STUDY_AREA	Area of Study
Survey Day: OBSERVAT_3	Day in which the data was collected.
Survey Month: OBSERVAT_2	Month in which the data was collected.
Survey Year: year	Year in which the data was collected.

Appendix F. Continued

Attribute Category	Definition
SURVEY_CN	Unique key generated by the source NRIS database for each survey. Aquatic Surveys data only.
SURVEY_NAM	Name of Survey
Taxa Level	Taxonomic level for the organism(s) observed.
Time: FAOBS_TIME	Observation Time
Total Detected: FAOBS_TOTA, NumSeen1, Amount_, Total	Total number of individuals observed.
Track	WYNDD Tracking Status: Y=Tracked by WYNDD; W=watched
TRS: TRS_APPROX	Township, Range, and Section notes
TSN	The unique ITIS (Integrated Taxonomic Information System) taxonomic serial number that is assigned to each taxon's scientific name.
UNK	Amount of Unknown Turtles seen
Unknown: Unclassed	Number of Individuals with an unknown sex
UTM_East: FAOBS_UTM_, UTM_EASTIN	The Site polygon centroid UTM Easting coordinate. For features with a longitude less than 120 degrees UTMs are calculated based on UTM Zone 11, NAD 83; features with a longitude greater than 120 degrees, UTMs are calculated based on UTM
UTM_Northing:FAOBS_UTM, UTM_NORTHI	The Site polygon centroid UTM Northing coordinate; calculated based on UTM Zone 10, NAD 27.
UTM_DATUM	Datum the UTM coordinates use
UTM_Zone:FAOBS_UT_1	The UTM grid-zone that the Site is located in.
X_SPNAD83H	X coordinate in Stateplane south nad83 HARN
Y_SPNAD83H	Y coordinate in Stateplane south nad83 HARN
Young	Number of Young Observed

Appendix F. Continued

TABLE F.1. List of Attribute Categories with Unknown Definitions

A_LAST_MOD	ACCIDENTAL	Activity	ALT_NAME
AMOUNT_OF_	AMOUNT_OF1	Animal_ID	ANNOBS
Area	ASPECT	BCSEE_SPEC	Biotics_So
BREEDS_IN_	BUFFERDIST	C_LAST_MOD	CALC_REP_A
CALLIST	Cat_____Ob	CDFG	CF_PRIORIT
CMN_OBS_CN	CMN_SITE_C	CNPSLIST	Column_Sum
COSEWIC__1	COSEWIC_CD	COSEWIC_CO	D_EST_REP_
DATA_1	DATA_2	DATA_3	DATA_4
DATA_5	DATA_6	DATA_7	DATA_8
DATA_9	DATA_10	DATA_11	DATA_12
DATA_13	DATA_14	DATA_15	DATA_16
DATA_17	DATA_18	DATA_19	DATA_20
DATA_21	DATA_22	DATA_23	DATA_24
DATA_25	DATA_26	DATA_27	DATA_28
DATA_29	DATA_30	DATA_31	DATA_SENS
DATE_EMAIL	DATE_TIME_	DateDay1	DateMo1
DateYr1	Delete_Rec	Descriptor	DESIGN_C_1
DESIGN_C_2	DESIGN_COM	DISTCOM	ECOCOM
ELEMENT_OC	ELEVATION	ElevEst	ELMDATE
ENDEMIC_TO	EO_RANK_CO	EO_TYPE	EO_Worthy_
EONDX	ERR_COMMEN	EXOTIC_ID	F2
FAOBS_DA_1	FAOBS_GROU	FAOBS_MO_1	FAOBS_SP_2
FAOBS_SP_3	FAOBS_TO_1	FAOBS_VERS	FASITE_ARE
FCODE	Feat_Code	FEATURE_CO	FEATURE_IN
FED_STAT_1	FEDLIST	FIELD_Na_1	FIELD_Na_2
FIELD_Na_3	FIELD_Na_4	FIELD_Na_5	FIELD_Na_6
FIELD_Na_7	FIELD_Na_8	FIELD_Na_9	FIELD_Na_10
FIELD_Na_11	FIELD_Na_12	FIELD_Na_13	FIELD_Na_14

Appendix F. Continued

FIELD_Na_15	FIELD_Na_16	FIELD_Na_17	FIELD_Na_18
FIELD_Na_19	FIELD_Na_20	FIELD_Na_21	FIELD_Na_22
FIELD_Na_23	FIELD_Na_24	FIELD_Na_25	FIELD_Na_26
FIELD_Na_27	FIELD_Na_28	FIELD_Na_29	FIELD_Na_30
FIELD_NAME	FIXED	FTR_CN	Funding_so
FURBEARER	ID	Incidental	INDEPEN_SF
INDEPENDEN	INVENTORY_	KEYQUAD	LandMgr
LAST_UPD_1	Legal_Desc	Life History	LOC_ERR_m
LOCAL_CODE	Location_A	MANAGED_AR	MANAGEMENT
MAP_QC_STA	MAX_ELEV_F	MERIDIAN	MICROHAB
MIN_ELEV_F	Name Type	NAME_CATEG	NATIONAL_G
NATURESE_1	NOCCSCNT	NOCCSTOT	NON_QC_VIS
Number_	O_LAST_MOD	OCCNUMBER	OCCRANK
OccurType_	OID_	OwlSiteC_1	OwlSiteCen
OWNERMGT	Pending	Photo	Point_M
Point_Z	POND_2010	POP_TYPE	Population
PRECISION	PRESENCE	Project_Co	Project_ID
Project_we	PROTECTION	Protocol_N	PROVINCI_1
QC_DATE	QC_NAME	QC_STATUS	QTRSECTION
QUAD_CODE	QUAD_NAME	Radius	RANGE
Ref	REGION	Relabundance	Repeat_
reported_E	SARA_SCHED	SECTION	SECURED_FL
SGCN_Ind	SHAPE_1_AR	SHAPE_1_LE	SHAPE_MODI
SIGN_OR__1	SIGN_OR__2	SIGN_OR__3	SIGN_OR_AC
SiteCode	SIZE_MIN_i	SIZEMAX_in	SLOPE
Source_F_2	Source_Fea	SOURCE_G_1	Source_ID
SourceDB	SPATIAL__1	SpCertaint	SPECIES_TR
SPX	SPY	STATE_ST_1	Subsite
SURVEY_ID	SURVEY_INT	SURVEY_OBS	SURVEY_STA

Appendix F. Continued

SURVEY_TAR	TAXACODE	THEMEFIELD	THRTCOM
TOTAL_VISI	TOWNSHIP	TRACKSTAT	TREND
UPDATEDATE	UTM_SOUCE	VISIT_CN	VPD_UNIT_F
WGFD			

APPENDIX G. BRUCE BURY'S SUGGESTIONS TO DATASET

The following email and map are from Bruce Bury pointing out possible extirpated or marginal sites in the comprehensive dataset we put together.

Hi Dede and all,

Thank you for all the valuable information.

Please welcome to the project:

Patti Haggerty, GIS Coordinator

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The distribution of this turtle is complicated by human intervention. In British Columbia, it may have been native (based on observations prior to 1950). Apparently, now extirpated. However, a dozen or so have been imported and released in more recent years in one lake outside of Vancouver, B.C.

In Puget Sound area, the turtle was present starting with its type locality near Fort Lewis (S of Tacoma), WA. Some populations may have disappeared but now stock from other locales (mostly Columbia R gorge) are released in the Puget Sound.

Your map shows one site in or near Bend, Oregon. I think they were introduced there (Simon Wray, ODFW, pers. comm.). Simon has been 6 or so in the Deschutes River right in town. I suggest making any in Bend as an "X" or a marginal site.

Nevada records are debated, but I have tracked down material in Native American middens back 3,000 yrs. There are quite a few sightings (see attached list from Nevada Dept of Wildlife). And, I have more but they are not needed here. There are published accounts and rebuttals. Their genetic profiles are being examined (Brad Shaffer and Phil Spinks work in Calif),

but results are not here today. I am working on a separate paper on the biogeography of the turtles in these areas (w. Nevada, northeast Calif., etc.). None of these on-going studies count until in print.

Here, I suggest use of the "X" for marginal sites or other status (now extinct, possible native). I offer that as the primary map (please see 2nd attachment). There are sides or arguments to be made for many areas in its range. Some are published (see 3rd attachment). We need to keep eye on target here: a distribution map to aid the reader of where the turtle occurs. I do not want to trigger big discussions (and, trust me, these have erupted in the past and will continue; all fine but not for this handbook).

I lack time to sign contracts with the databases. You have permission to use (as shown) and all we need for the handbook. If I looked at each entry, I might start arguing some. For example, I have checked some records in the past. Once, claim of W Pond turtles in a Fort Lewis lake turned out to be melanistic Red-eared sliders. Observations are usually correct, but some exceptions.

We need a Figure Legend (or Plate Legend). Also something such as: Prepared by Kimberly Barela, BioResource Research, Oregon State University; and Deanna H. Olson, Pacific Northwest Research Station, U.S. Forest Service

Two of my co-editors want this in color. I want it simplified a bit (combine first two categories into one "<1900"). My issue, but if Plate #1 (all color figures are in plates in middle of book), then I have to renumber the others. If Black and White, it would become Figure 1 (and then renumber the other figures). Things to do later.

Maybe the GIS experts should discuss the next step. Patti and Kelly and Kimberly?

take care, rbb

R. Bruce Bury

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Corvallis, OR 97331

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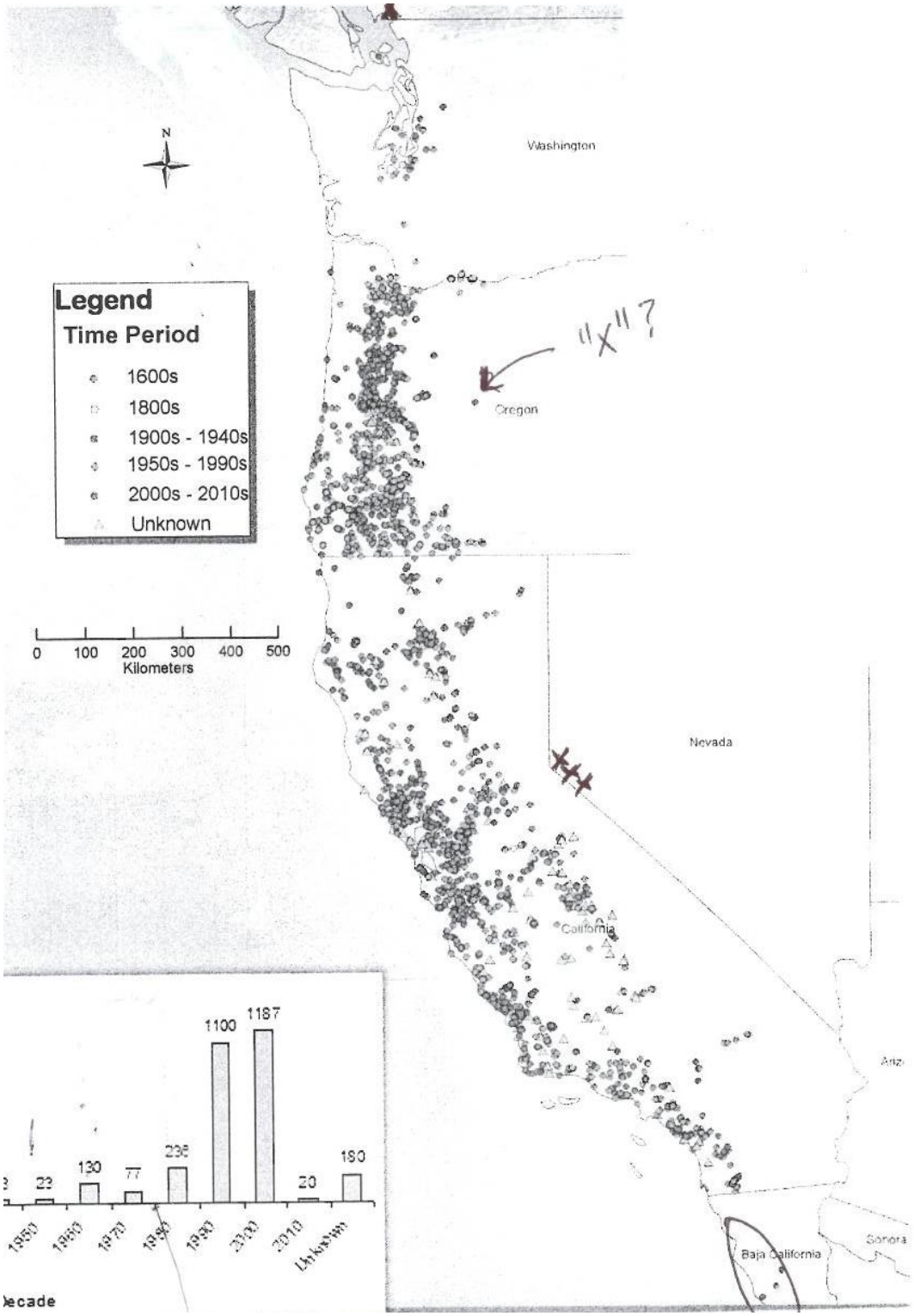
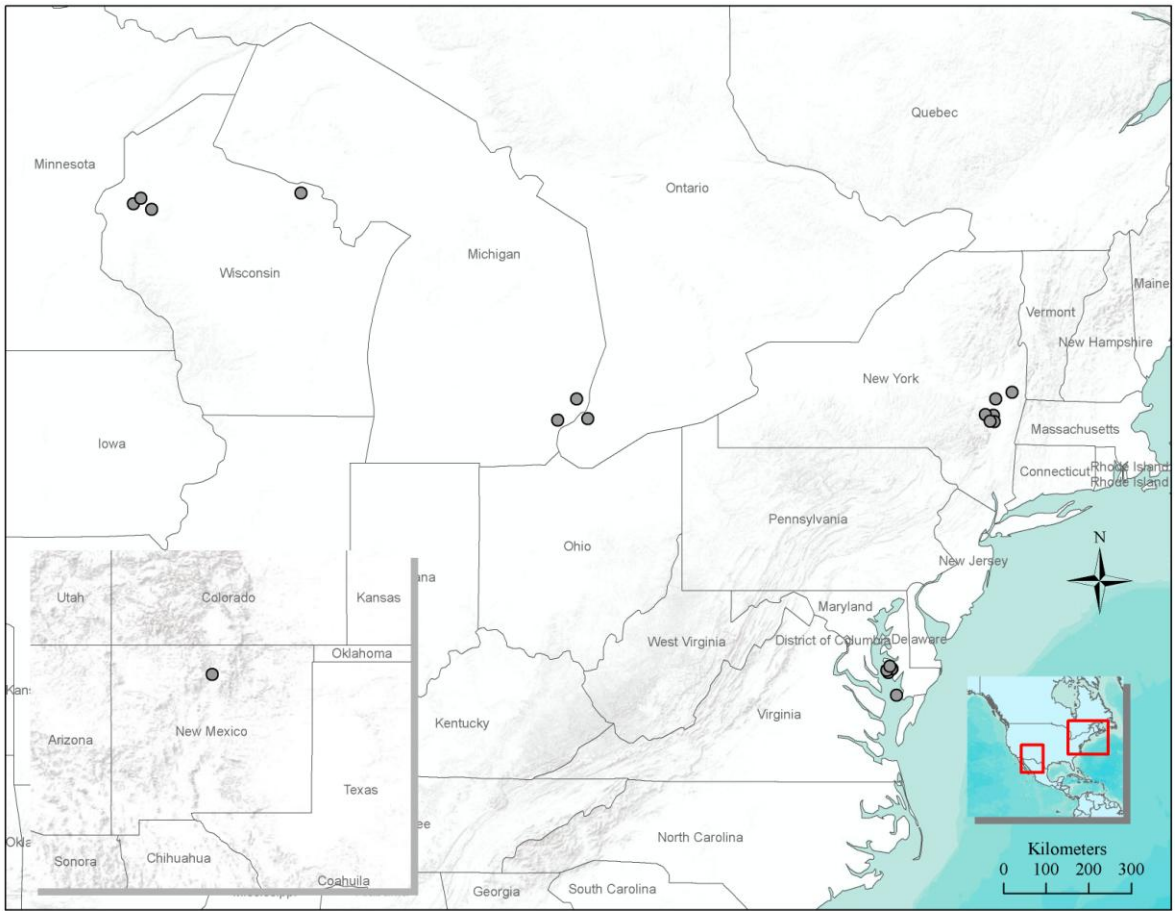


APPENDIX H. EASTERN SUBSET OF THE PAINTED TURTLE RANGE

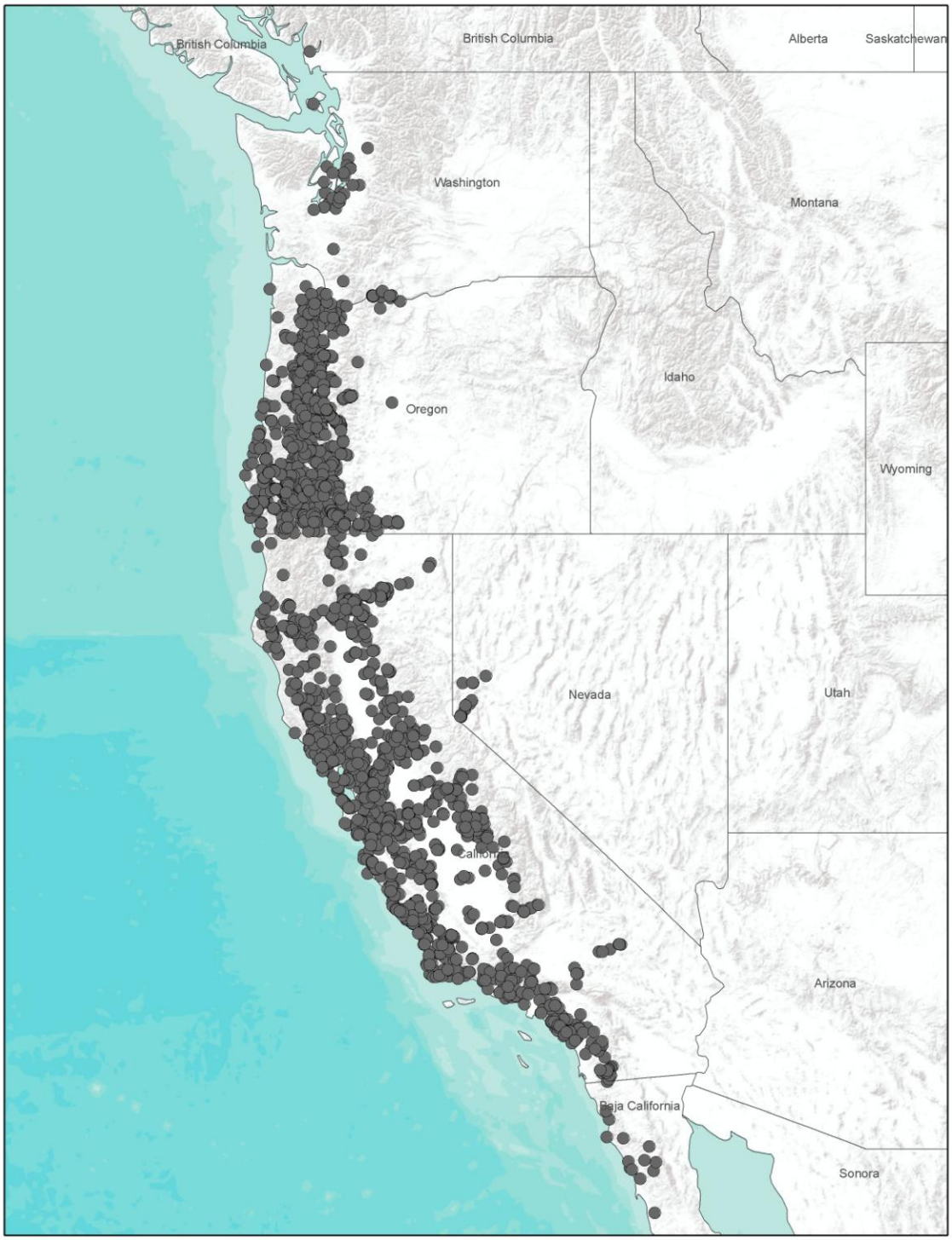
Through the US Turtle Mapping Project initiated by the 2011-Year of the Turtle campaign, new Painted Turtle observations were received from other locations in the United States. Due to time constraints, local databases were not acquired to extend the scope of this project to these states, and full mapping of turtle locations was not conducted except in the northwest. Southern and eastern Painted Turtle locations collected over the course of this project are compiled here (Figures H.1).

FIGURE H.1. Painted Turtle locations received during 2011-Year of the Turtle.



APPENDIX I. GENERAL RANGE MAP OF WESTERN POND TURTLE

Figure I.1. Distribution of the Western Pond Turtle.



APPENDIX J. GENERAL RANGE MAP OF PAINTED TURTLE

Figure J.1. Distribution of the Painted Turtle in northwestern North America.