Assessment of Western Pond Turtle Population Genetic Structure and Diversity in Southern California

DFG Funded Project (State Wildlife Grant/General Fund) and USGS

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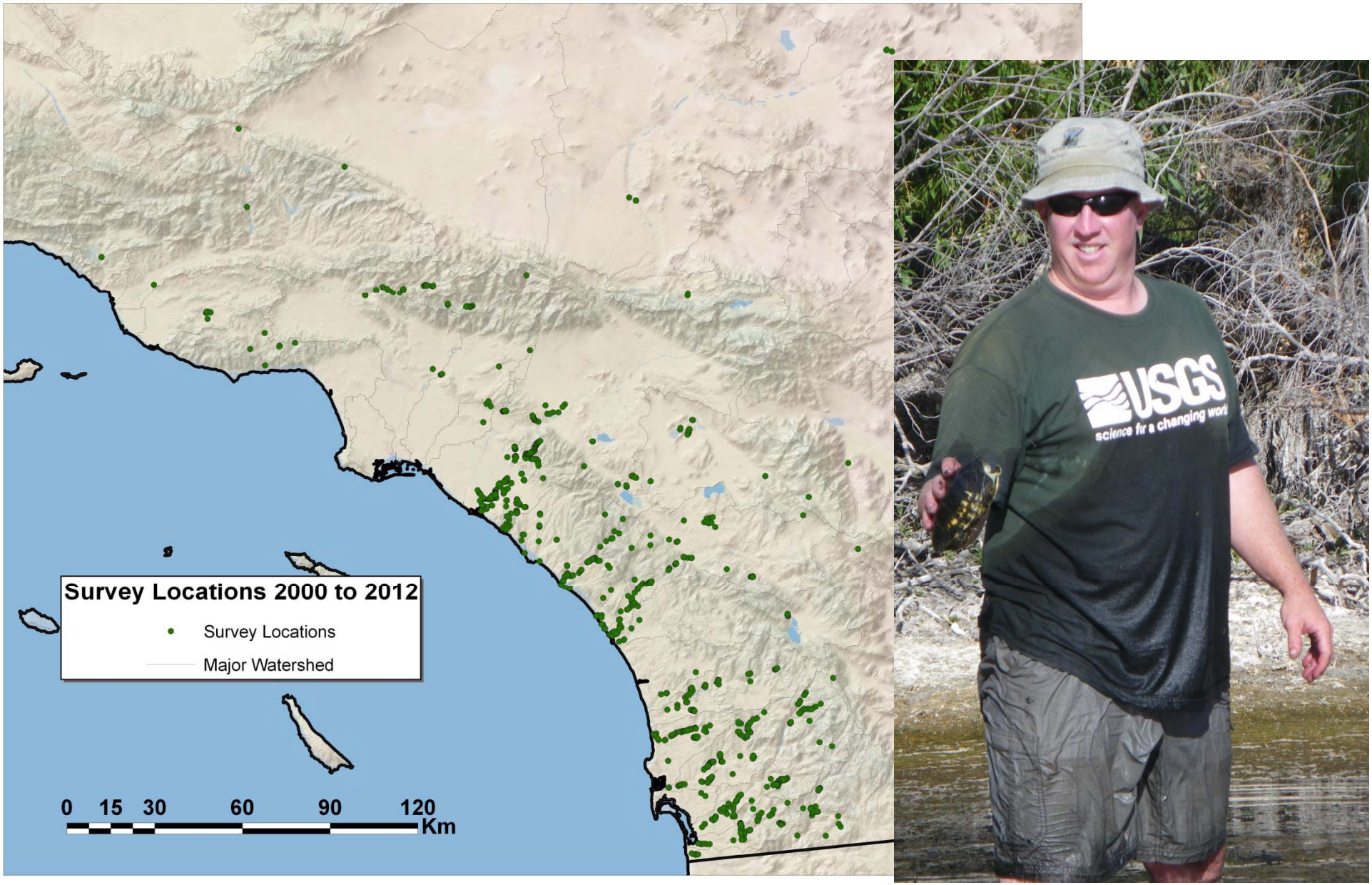
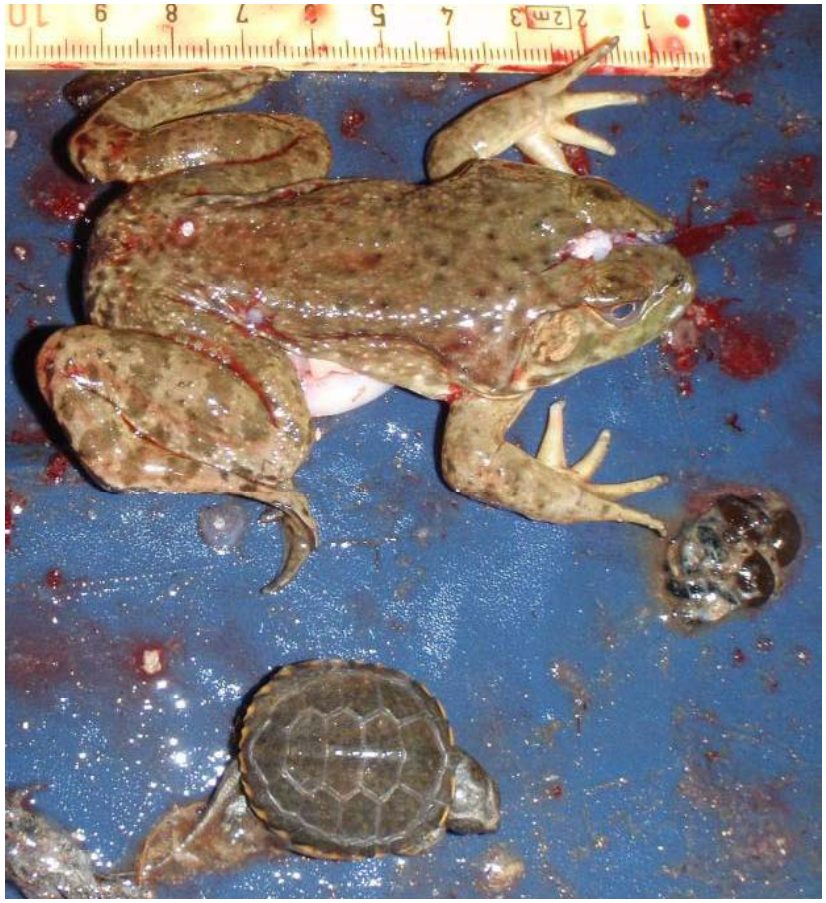
Goals and Questions

- Determine status of PT pops throughout s. Cal.
- Determine stressors impacting viability in s. Cal.
- Use/develop more sensitive genetic markers for assessing within/between species diversity
- Assess genetic regional boundaries found in the Spinks and Shaffer 2005 paper.
- Develop management strategies for pond turtle population enhancement/viability

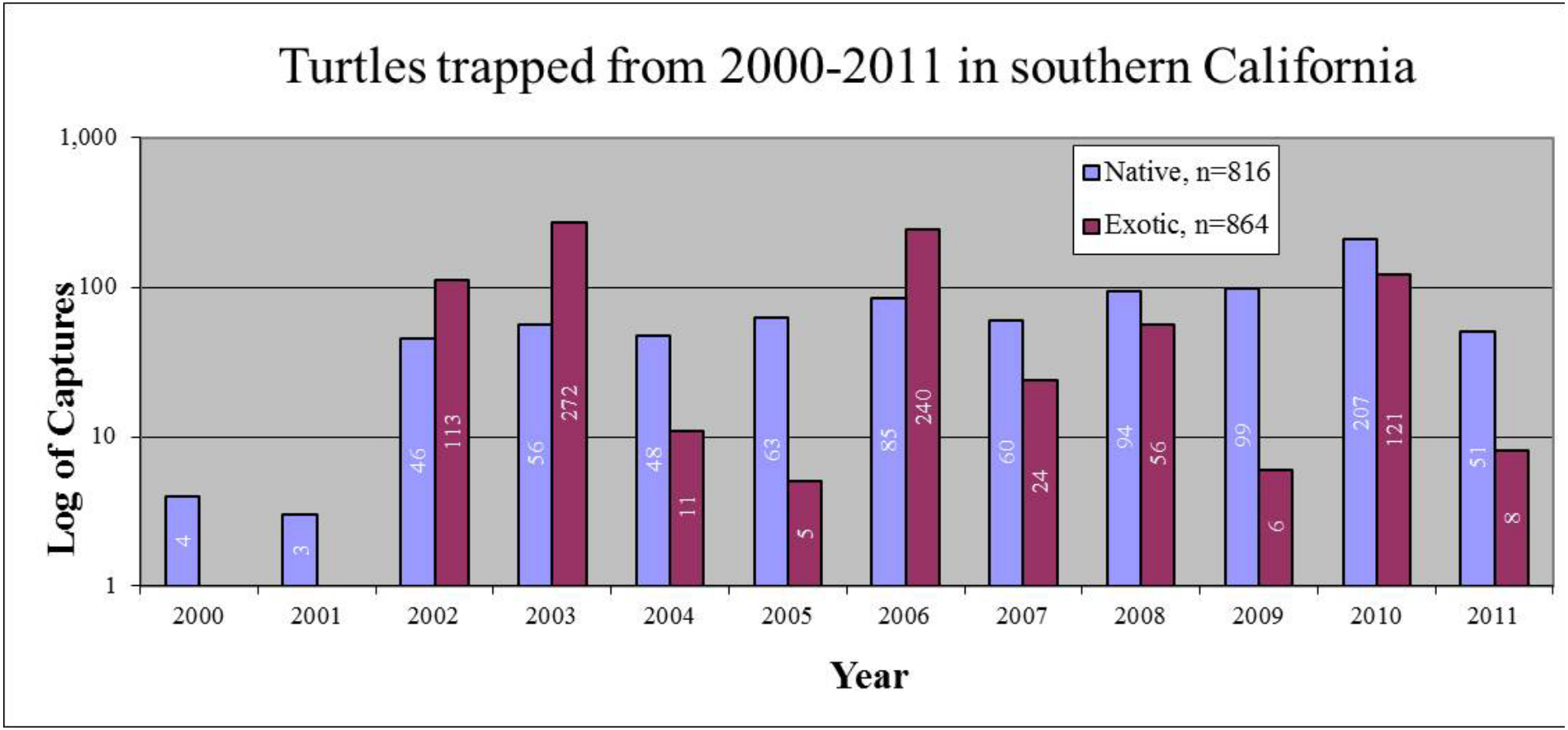


Survey locations for pond turtles from 2000-2012. Includes both turtle trapping and visual encounter surveys (514 sites; 3,545 individual events). Includes data from CDFG, Western Riverside County MSHCP, United Water District, and RCD of the Santa Monica Mountains.



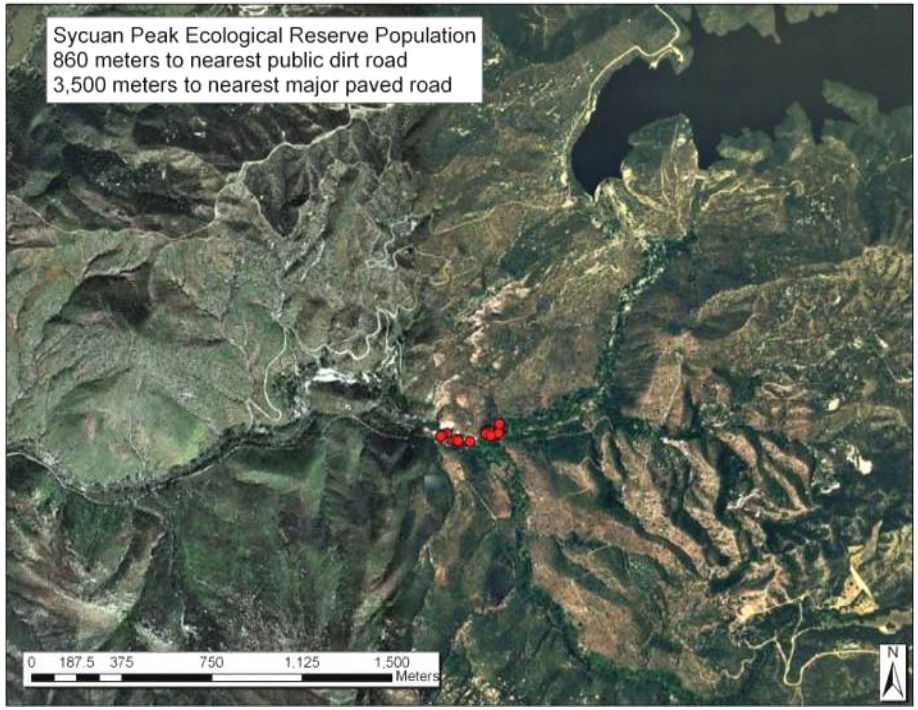
Non-native turtles

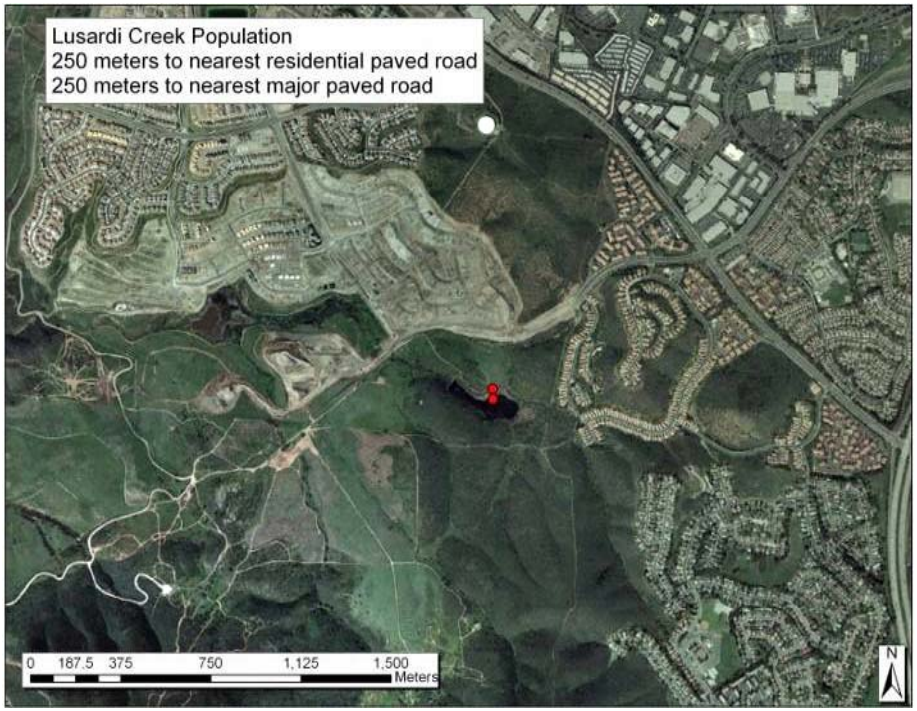
Many issues with pond turtles in southern California. Predation by invasives, competition and disease spread from exotics. Lack of biosecurity in reserves, etc.

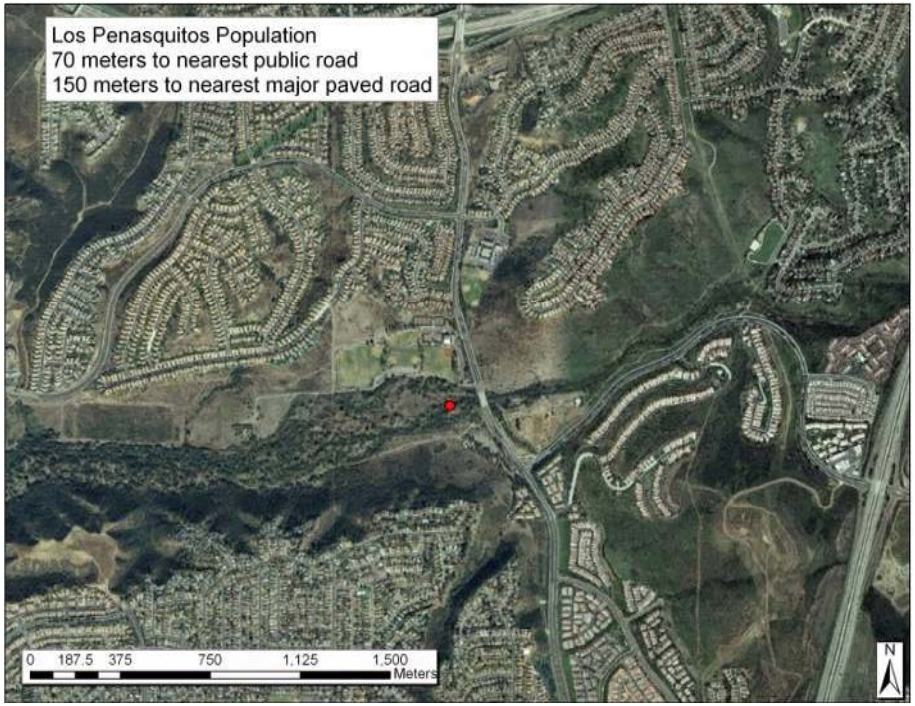


Survey results for pond turtles from 2000-2011. Includes turtle trapping surveys only. Includes data from USGS and CDFG.

Different Turtle Species Trapped in So. California







Fragmentation impacts on pond turtle sex ratios

Males vs. females detected at each site and the distance of the population to the nearest major road (two or more lanes in each direction).

Los Penasquitos (150m): 6 males, 0 females

Lusardi Creek (250m): 11 males, 1 female

Sycuan Peak (3,500m): 10 males, 9 females

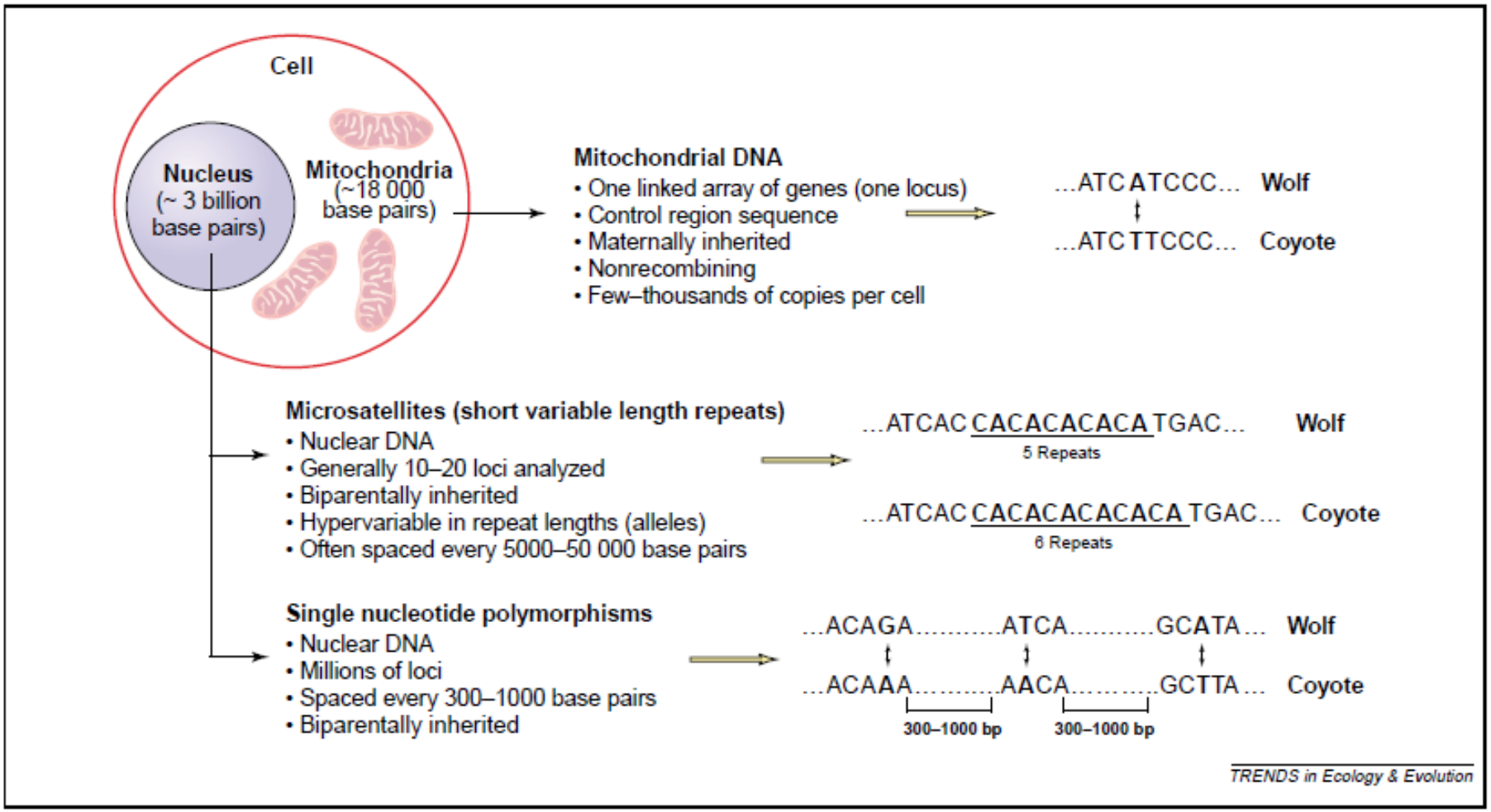
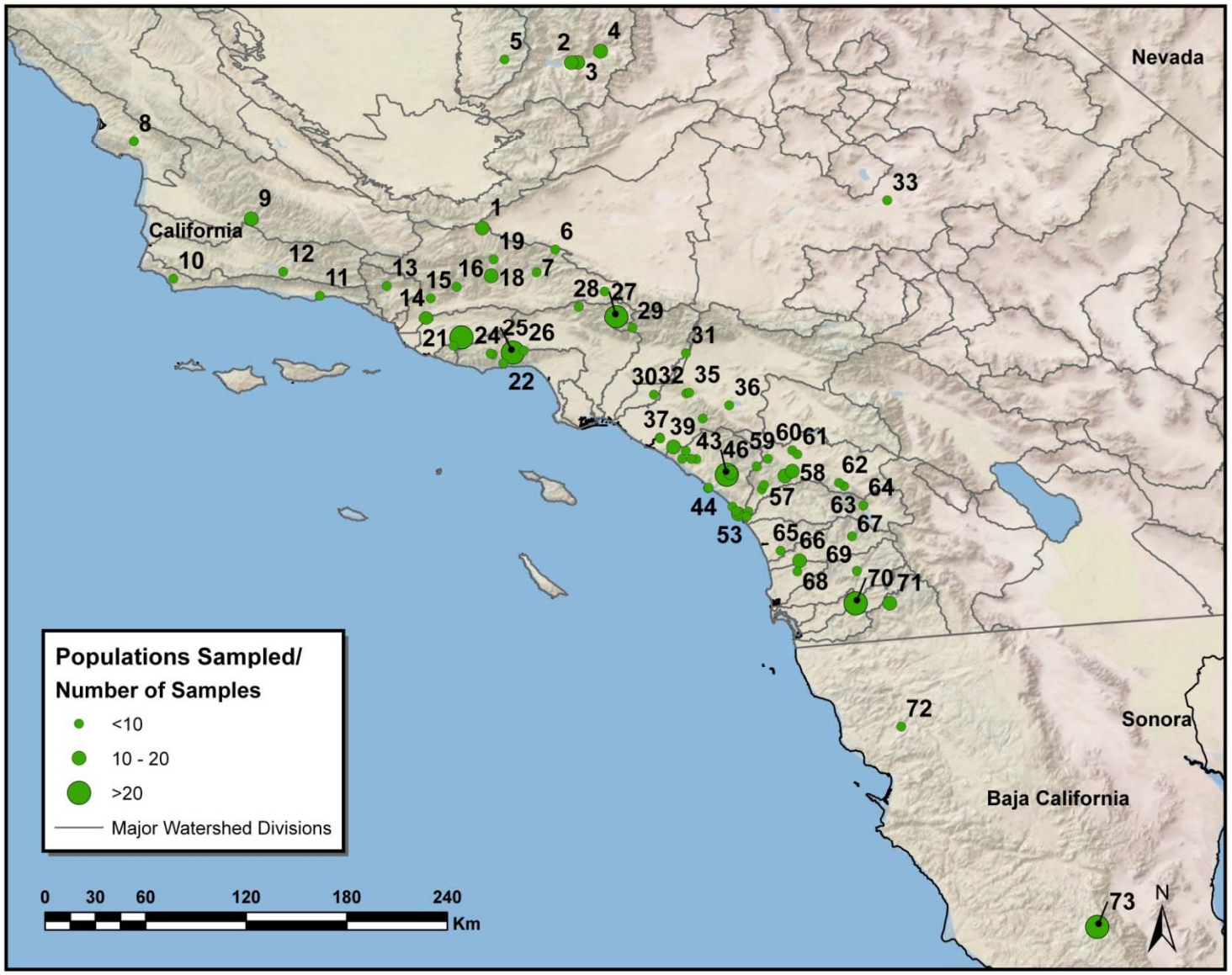
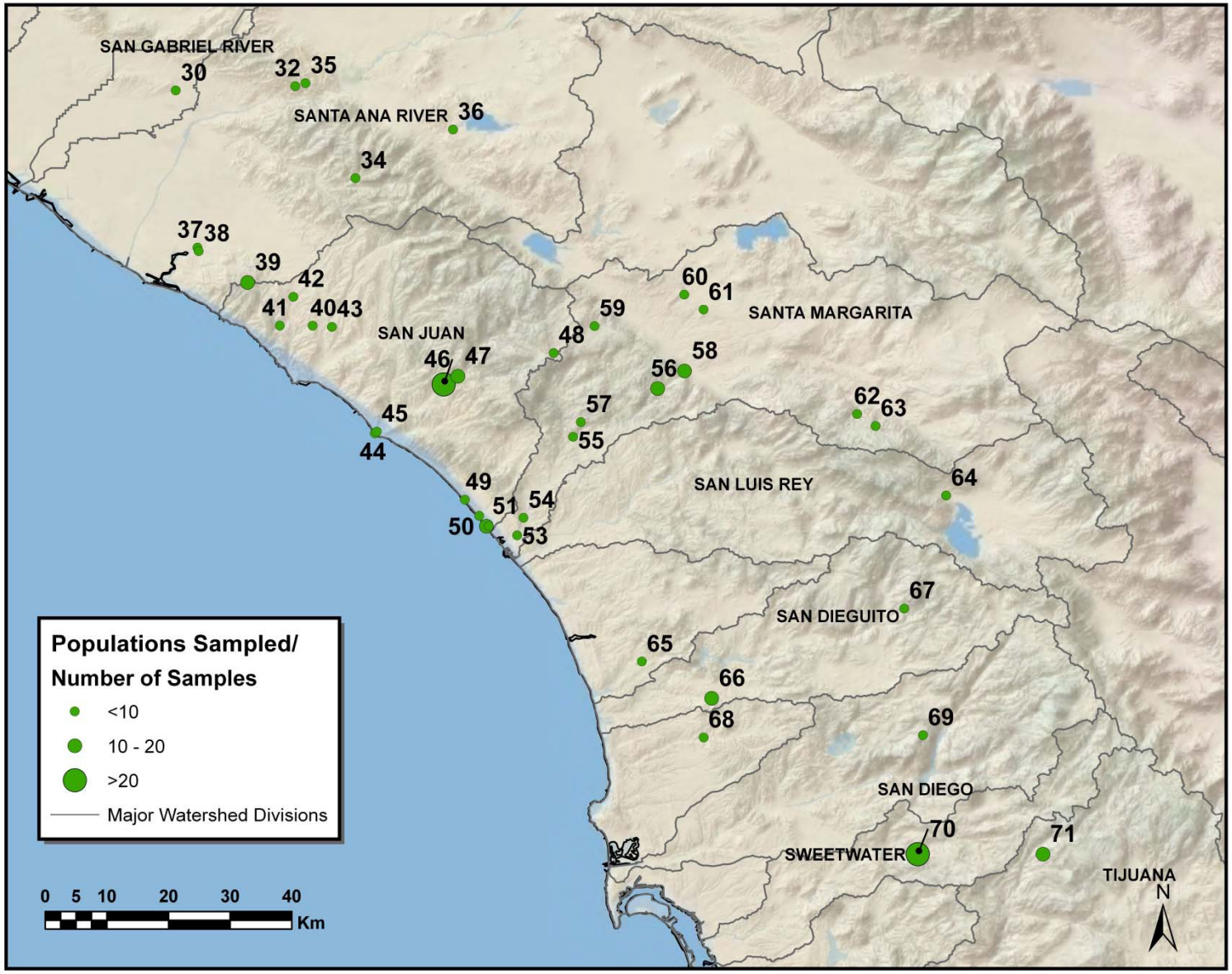


Figure 1. Comparison of the characteristics of mitochondrial DNA (mtDNA), microsatellites [63] and single nucleotide polymorphism (SNPs) [4] as genetic markers (with examples of possible DNA sequence differences between wolf-like canids; these types of differences can be found within or between taxa).

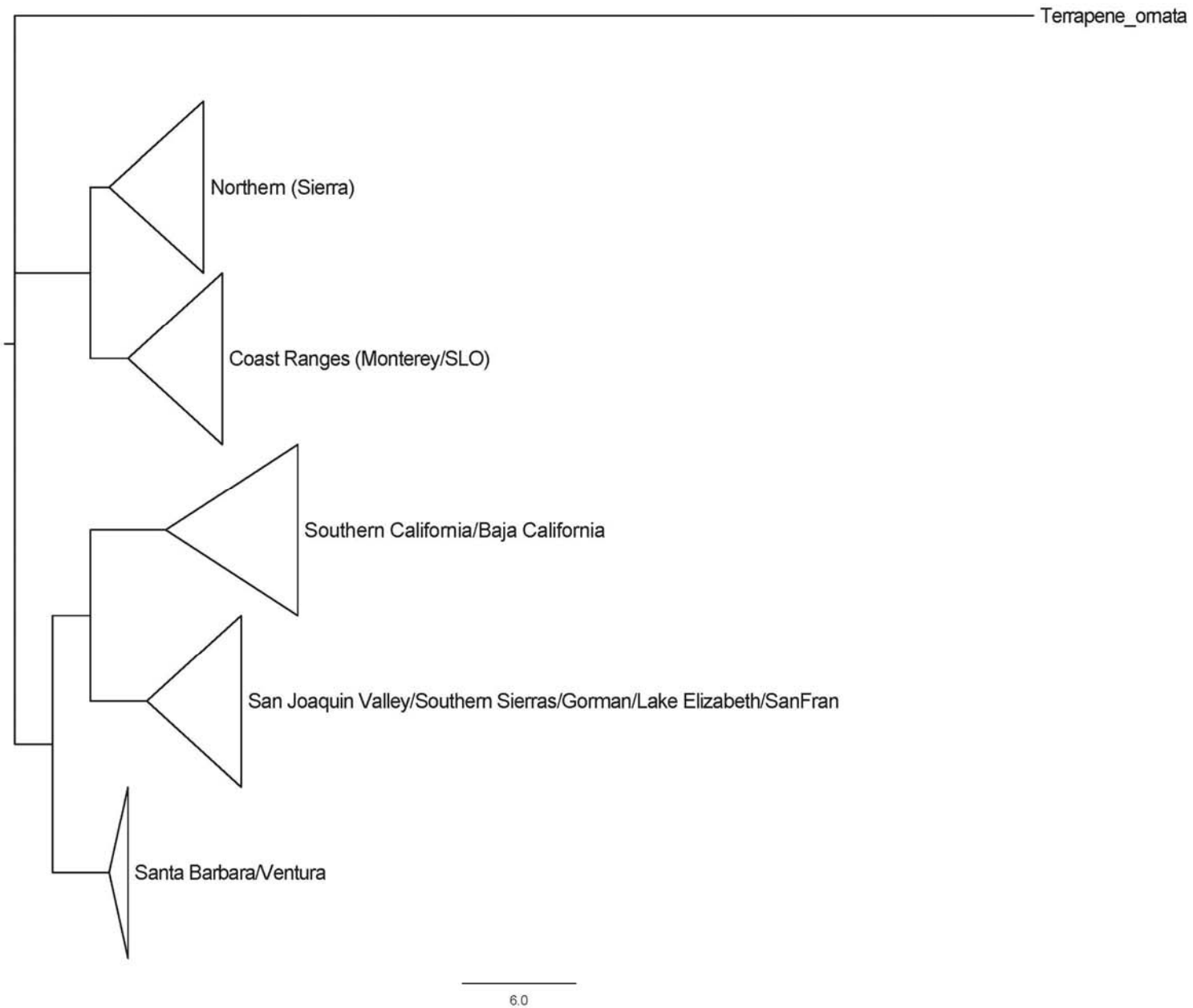
Morin, P.A., G. Luikart, R.K. Wayne, and the SNP workshop group. 2004. SNPs in ecology, evolution and conservation. Trends in Ecology & Evolution 19:208-216



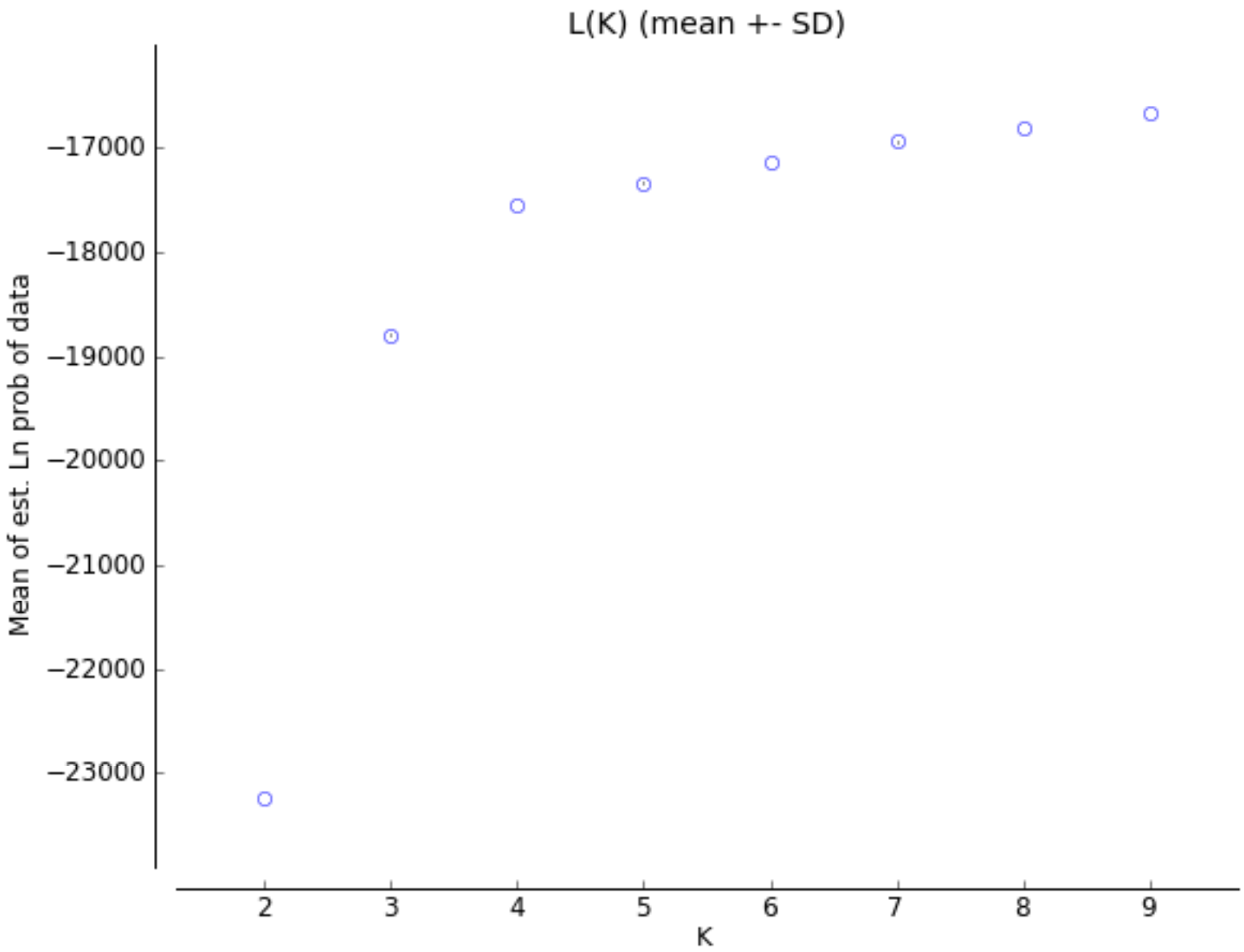
Turtles included in the SNP genetic analysis. This includes turtles previously collected by Dan Holland and available through UC Davis. Population numbers are referred to in the text and in the STRUCTURE results. Size of point relates to sample size for that population. 4 digit HUCs are overlaid, which are the same as the CalWatershed Level 2 subregions.



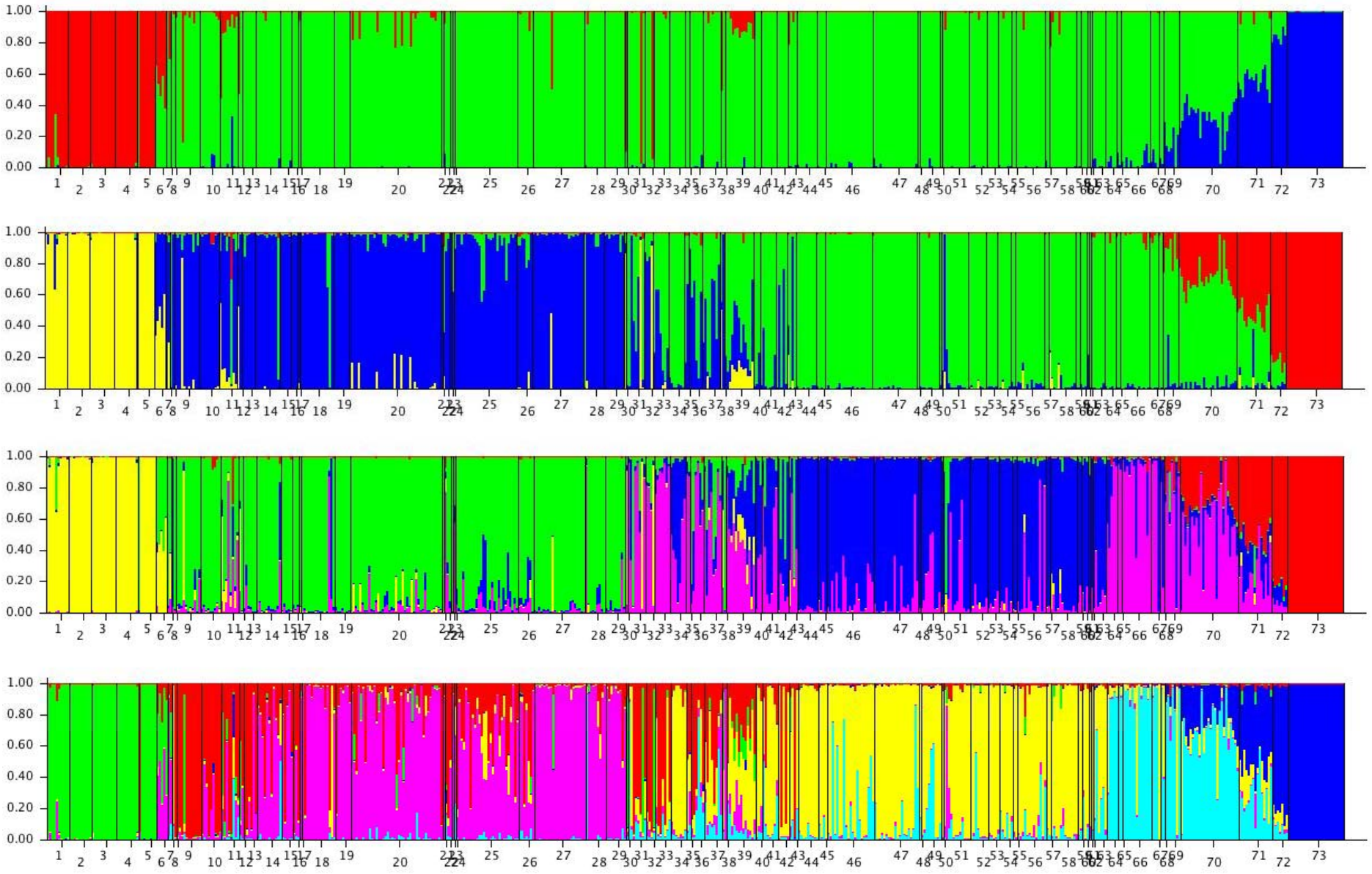
Turtles included in the SNP genetic analysis, close-up of the San Diego and Orange County populations included in this study. Population numbers are referred to in the text and on the STRUCTURE results. Size of point relates to sample size for that population.



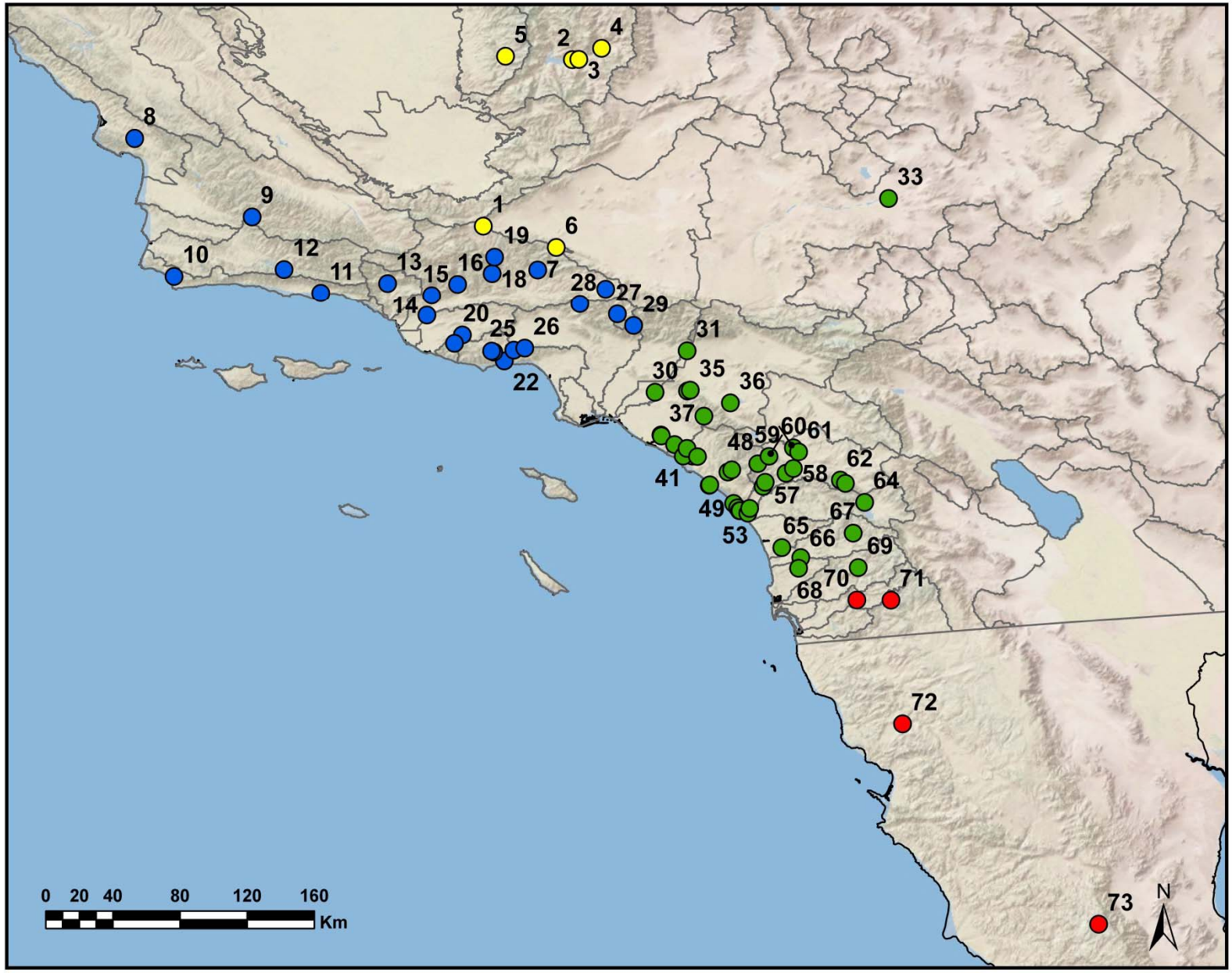
Neighbor Joining tree for pond turtles (mtDNA), including new sequence data for 200+ individuals for southern California. Includes already published data from Spinks and Shaffer (2005) and Spinks et al. (2010). These clade names are used in the text.



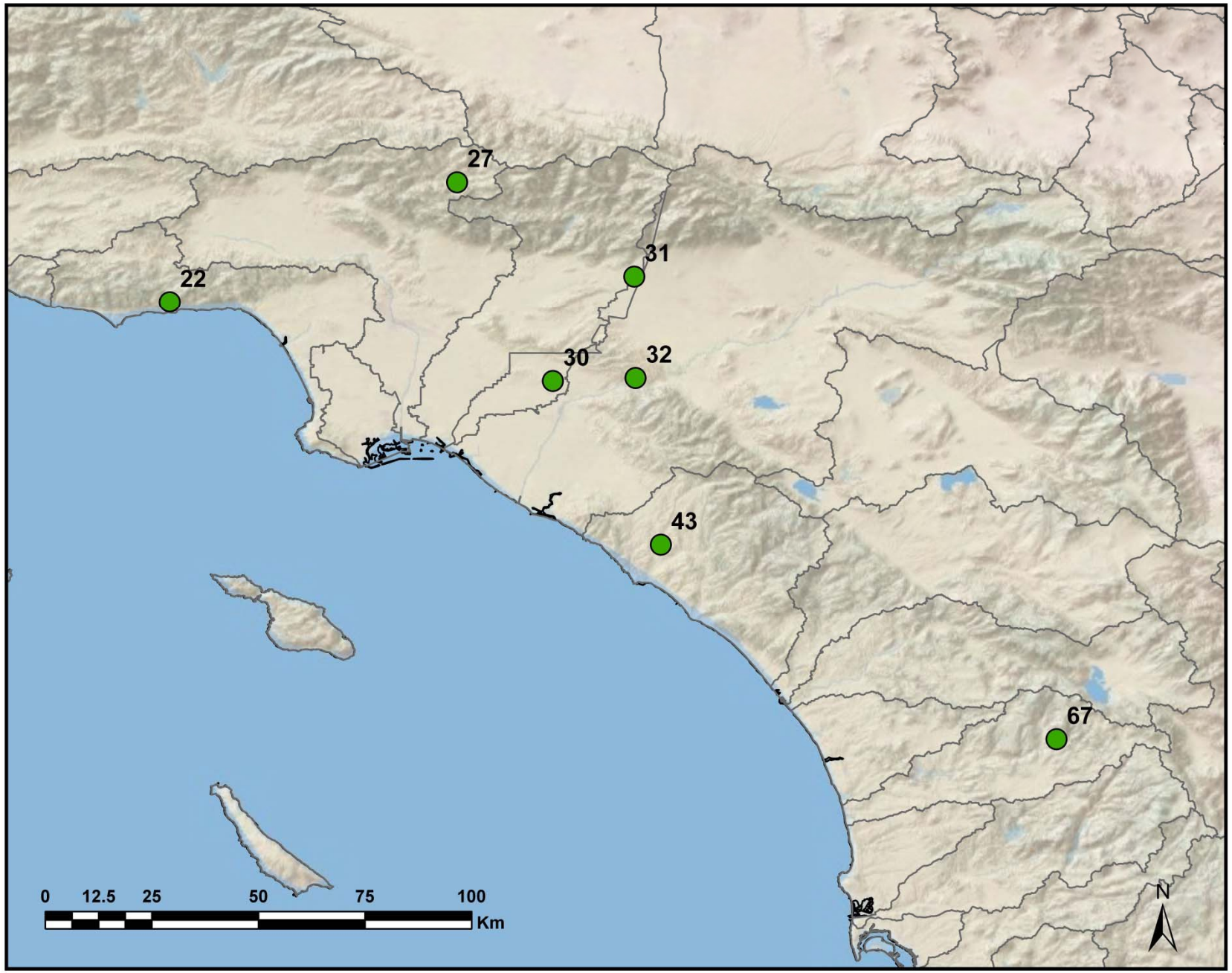
Analysis of SNP variation in pond turtles utilizing Structure v2.2.3. Plot of posterior likelihood of the data with increasing number of clusters (*K*), greatest gain is *K*=3, with no distinct plateau (*K*: 4 – 9).



Bar plots of posterior probabilities of individuals generated using Structure v2.2.3. Plots are ordered for cluster membership, from top, *K*=3, *K*=4, *K*=5, and *K*=6. 580 individual turtles are represented on each plot. Population numbers relate to Table 1 and are ordered from north to south (left to right).

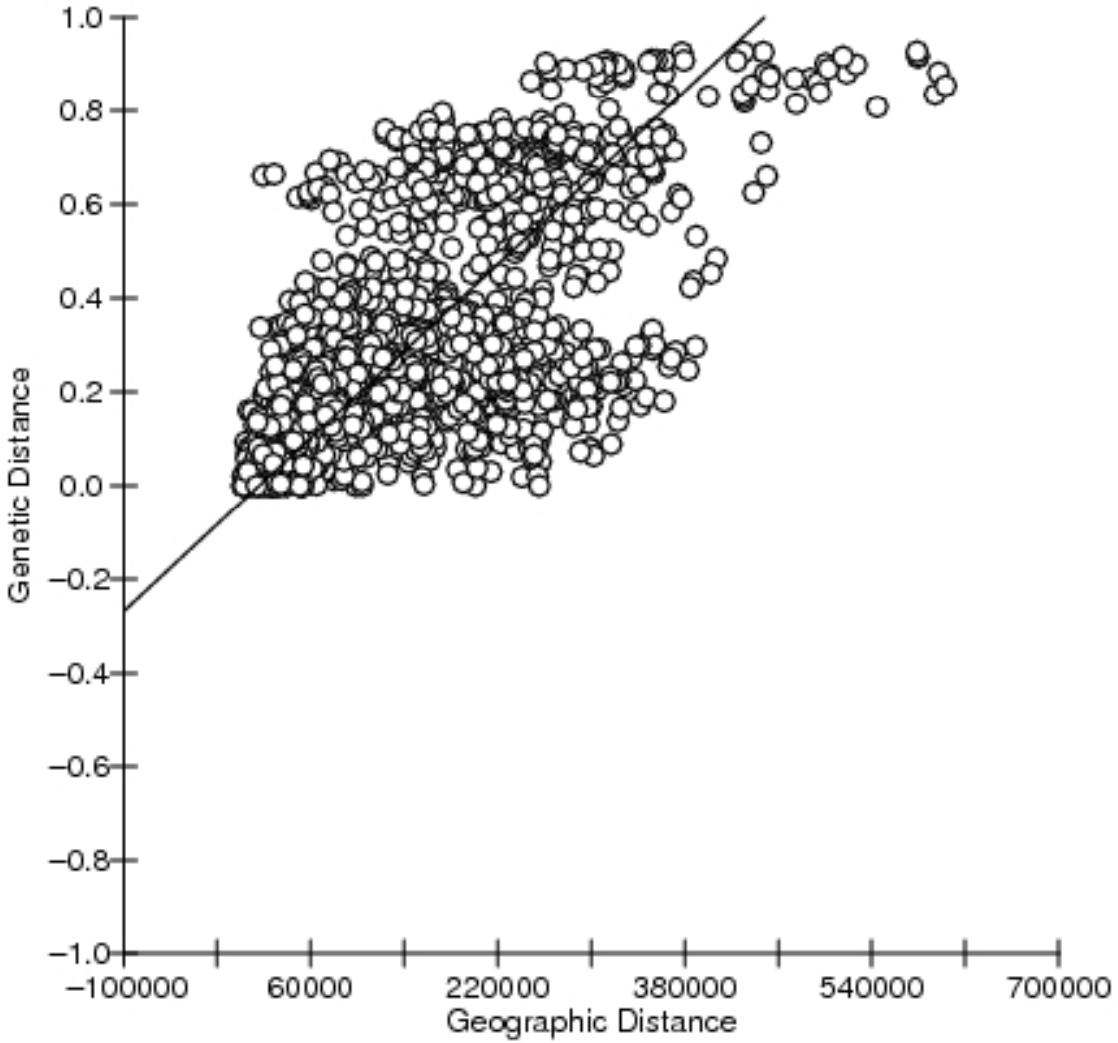


Assignment of SNP variation in pond turtles utilizing Structure v2.2.3, and *K*=4. Different color relate to different groupings from the analysis.



Sites where “introduced” pond turtles were identified using the genetic techniques. This is evidence that there is more movement of turtles in southern California by people then is documented.

Pond turtle (TM8-11-13) captured in 2008 along Santa Ysabel Creek, San Diego County, upstream of San Pasqual Valley and downstream of Boden Canyon, found during post-fire arroyo toad surveys. This turtle was thought to be native, and was pit-tagged and released. We know from the mtDNA results that it is from northern California, probably from the Sierra Nevadas, and was released or escaped as a pet. Fresh chew marks are seen on its shell.



Pairwise Fst Values for all populations plotted against the geographic distance between populations illustrating a pattern of isolation by distance within between the populations of this species that were sampled.