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The Ecological Benefits of Protected Areas in California Funded Through Local Direct Democracy

Chad Michael Stachowiak
University of Tennessee, cstacho1@vols.utk.edu

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I am submitting herewith a thesis written by Chad Michael Stachowiak entitled "The Ecological Benefits of Protected Areas in California Funded Through Local Direct Democracy." I have examined the final electronic copy of this thesis for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Science, with a major in Ecology and Evolutionary Biology.

Paul R. Armsworth, Major Professor

We have read this thesis and recommend its acceptance:

Charles Kwit, Michael L. McKinney

Accepted for the Council:
Dixie L. Thompson

Vice Provost and Dean of the Graduate School

(Original signatures are on file with official student records.)

The Ecological Benefits of Protected Areas in California Funded Through Local Direct Democracy

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ABSTRACT

Recent research shows current conservation funding falls short of what is required to meet conservation targets. However the expansion of conventional funding sources to bridge this shortfall is not likely to occur. Conservation organizations may be able to leverage unconventional funding sources and protection mechanisms, such as protected areas (PAs) funded through the local ballot box, to fill the gap. However, there are concerns that such PAs may be biased in their protection. Additionally, before other forms of conservation can be included in planning, the quality of the benefit provided must be confirmed. In Chapter 1, we show how the protection of species and habitat types by ballot box PAs compares to two PA types funded by more conventional means in the state of California. We make these comparisons using two different data types for species and habitat types: presence and proportion of range covered. We find that ballot box PAs do not protect a different number of habitat types than would be expected from random nor do they represent habitat types disproportionally different than are found across the entire state of California. We find mixed results for species that are affected by the data type (presence vs. range) and species class (e.g. amphibian, bird, mammal, reptile). In Chapter 2, we show how the condition of PAs funded through action by local communities at the ballot box compares to protected areas funded by a state public agency as estimated by coverage by exotic species. We then show if properties of the PAs or human-mediated onsite disturbance are able to predict the coverage by exotic species. We find that exotic species coverage does not differ between PA types. In our sample, elevation was the only significant predictor of exotic species coverage. Our findings suggest that ballot box PAs protect representative habitat types, but may disproportionately protect more common species and that ballot PAs are in no poorer condition than a conventional PA type funded by a state public agency.

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INTRODUCTION

The study of conservation biology is premised on preserving biodiversity (Soulé, 1985). The Convention on Biological Diversity defines biodiversity, or biological diversity, as "*the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part: this includes diversity within species, between species and of ecosystems*" (CBD, 1992). When biodiversity is high in a biological system, the system is thought to have increased stability and productivity compared to a system with a low level of biodiversity (Tilman, Isbell, & Cowles, 2014). Biodiversity also contributes to many other ecosystem services (e.g. pollination and seed dispersal of agricultural crops, climate regulation, water filtration) that human society has come to rely on and perhaps has taken for granted (Millenium Ecosystem Assessment, 2005c). Losing biodiversity therefore stands to threaten the provisioning of those ecosystem services to society (Díaz, Fargione, Chapin III, & Tilman, 2006).

At the species level, biodiversity is presently being lost at rates much higher than estimated pre-human extinction rates (Pimm, Russell, Gittleman, & Brooks, 1995). Primary drivers of the increased global rates include habitat degradation/loss, climate change, invasive alien species, overexploitation of species, and pollution (Millenium Ecosystem Assessment, 2005b). Those same drivers have also been implicated in the loss of biodiversity in the United States (Stein & Kutner, 2000; Wilcove, Rothstein, Dubow, Phillips, & Losos, 1998). Climate change was inferred by authors in that study to be a threat to biodiversity in the United States, but it was not documented as such in the sources used for the analysis. Globally and in the United States, habitat loss and degradation is the most frequently cited driver threatening species. Globally this is evidenced by the substantial loss of natural land cover in 12 of 14 biomes from 1950 to 1990; with losses for four biomes being greater than 14% (Millenium Ecosystem Assessment, 2005a). A prominent example of widespread habitat loss in the United States is that of wetland habitat. From the 1780s to 1980s, it sustained an estimated loss of over 47 million hectares or 53% of the historic habitat (Dahl, 1990).

A principal strategy for mitigating the effects of habitat loss is the preservation of land through the creation of protected areas (Chape, Spalding, & Jenkins, 2008). As defined by The International Union for Conservation of Nature (IUCN) at the 4th World Parks Congress, a protected area is "*an area of land and/or sea especially dedicated to the protection and maintenance of biological diversity, and of natural and associated cultural resources, and managed through legal or other effective means*." At the end of 2005, more than 19 million km^2 across the globe, equivalent to 12.9% of the Earth's land surface, was attributed to protected areas in the World Database on Protected Areas. The parties of the Convention on Biological Diversity established a goal to increase that level of protection to 17% of Earth's surface by 2020 (CBD, 2010). However, protected areas vary in all manner of respects, meaning they will have differing usefulness for conserving biodiversity (McDonald & Boucher, 2011). One common concern about our existing protected areas is that, historically, publicly protected areas disproportionately protected land that was not economically viable for extractive use (e.g. farming, forestry, mining), remote, uninhabitable, or some combination thereof (Joppa & Pfaff, 2009; Pressey, 1994). These biases lead to many biodiversity features being under-represented in protected areas (Stein & Kutner, 2000).

Even though protected areas are designated, there is evidence that many may not be adequately funded for effective management. Currently funding for allocated for protected areas also falls short of what would be needed to meet biodiversity conservation targets. A 2004 study found that funding to adequately manage existing protected area in developing countries was short USD$1-1.7 billion (Bruner, Gullison, & Balmford, 2004). McCarthy et al. (2012) found that shortfalls in funding for effective management also applied to countries beyond those considered developing. Additionally, they showed that to secure global conservation targets of one group, birds, by securing all identified areas of significance for their conservation, funding would need to be increased nearly 17 times the current rate. If funding for biodiversity conservation cannot be met with present sources, alternatives must be found.

Determining what is already protected is a principal step in systematic conservation planning (Margules & Pressey, 2000). To not do so invites inefficiency in the allocation of what funds are available. However our understanding of what has already been protected is often incomplete because we lack centralized resources describing the protection efforts from the many, often times small, conservation actors involved (Armsworth et al., 2012). The Protected Area Database of the United States (PAD-US) and the National Conservation Easement Database (NCED) are two examples of centralized databases providing boundaries of protected areas in the United States. However, both predominantly focus on state and federal land holdings (Aycrigg et al., 2013). Data completeness has been improving with updates to the databases, but it can still be harder for the smaller, more localized public and private actors to be found in these databases. Understanding more about these smaller actors could improve the efficacy of future conservation efforts, by reducing redundancies and highlighting opportunities for collaborations and partnerships.

Land preserved using funding set aside at the local level through ballot measures is a case that may partly address shortfalls in conservation funding. Generally speaking, the government structure at federal, state, and local levels in the United States is based upon a representative system of democracy whereby voters elect officials to represent them and decide upon policy. At the same time, in a number of states, voters can propose and vote on policies and initiatives themselves using ballot measures as a form of direct democracy (Graves, 2012). Ballot measures have commonly been used to conserve land for reasons such as open space preservation, groundwater protection, and recreation (Kroetz, Sanchirico, Armsworth, & Banzhaf, 2014). Although biodiversity conservation may often not be the primary objective of these open space protection ballot measures, areas of habitat for species are nonetheless being conserved when open space is protected (Szabo, 2007). The protected areas funded by these ballot measures make promising candidates for examining potential biodiversity benefits because of the magnitude of funding involved. Over a 29 year period from 1988 to 2017, USD$76.2 billion was set aside by ballot measures in 46 states for land acquisition and protection (Trust for Public Land, 2018). At an annualized rate of USD$2.6 billion, this level of spending from ballot measures is comparable to the USD$1.8 billion annualized rate of the Conservation Reserve Program, one of the largest federal land preservation programs that is authorized by the federal Farm Bill (Jordan et al., 2007).

Ballot protected areas reflect motivations stemming from localized pressures and incentives to meet the demands of the electorate in a given jurisdiction. For instance, a local land trust or community action group may use the ballot to secure the last remnants of greenspace that was susceptible to growing development pressure. In other words, these protection efforts are motivated from the bottom up. This bottom-up, grassroots activity is the opposite of a more top-down approach to conservation activity led by a centralized authority. An example of this more top-down approach would be when a government (e.g. state or federal) is legally obligated to secure the protection of a natural resource (e.g. species, vegetative community, ecosystem, etc.) held in the public trust. The objectives and outcomes of these “opposing” approaches to conservation may not necessarily align and often do not. However, in the cases where they have complemented one another, it has worked out well for conservation. For example, in an analysis of the Little Karoo region of South Africa, Gallo et al. (2009) demonstrated that top-down protected areas covered particular biomes and habitat well, but were subject to the historical biases previously described and were able to meet a limited number of conservation targets. When bottom-up protected areas were also counted towards delivering conservation targets, many more targets were met, additional habitats and biomes were protected and the total land conserved was almost doubled.

In Chapter 1 of this thesis, we examine the geographic characteristics of ballot protected areas in the state of California and what potential contribution these bottom-up actions could make towards the conservation of biodiversity. In Chapter 2, we restrict focus to the San Francisco Bay area of California to determine if ballot protected areas differ in ecological condition from protected areas established by top-down conservation actors.

CHAPTER I

A COMPARISON OF THE DISTRIBUTION OF HABITATS AND SPECIES COVERED BY PROTECTED AREA TYPE

A version of this chapter will be submitted for publication by Chad M. Stachowiak and Paul R. Armsworth:

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Chad Stachowiak developed the idea for this manuscript, conducted the analysis, and wrote the manuscript. Paul Armsworth is a co-author of this work and was responsible for feedback at early stages of this manuscript's development and helping with editing.

ABSTRACT

Recent research shows current conservation funding falls short of what is required to meet conservation targets. However, the expansion of conventional funding sources to bridge this shortfall is not likely to occur. Unconventional funding sources and protection mechanisms, such as protected areas (PAs) funded through the local ballot box, may prove useful to fill the gap. However, there are concerns that such PAs may be biased in their protection. Here we show how the protection of species and habitat types by ballot box PAs compares to two PA types funded by more conventional means in the state of California. We make these comparisons using two different data types for habitat types and species: presence and proportion of range covered. We find that ballot box PAs do not protect a different number of habitat types than would be expected from random nor do they represent habitat types disproportionally different than are found across the entire state of California. We find mixed results for species that are affected by the data type (presence vs. range) and species class (e.g. amphibian, bird, mammal, reptile). This suggests that ballot box PAs protect representative habitat types, but may disproportionately protect more common species.

INTRODUCTION

Ballot protected areas, as a form of bottom-up conservation, are subject to the goals of the local communities involved in their protection. These goals are not necessarily subject to the same motivations driving the conservation of biological diversity. Also, the applicability of a ballot measure is subject to the jurisdiction in which it is passed (e.g. municipal, city/town, state). This limits how far the allocated funding can move thereby limiting it to the conservation of local biodiversity features. In contrast, top-down conservation actors can work at a larger spatial extent (e.g. state or national NGOs) and over larger jurisdiction (e.g. state or federal agencies). These top-down actors can make decisions explicitly based on maximizing the conservation of biological diversity and have the ability to allocate funding over that larger spatial extent.

A national analysis of the United States by Kroetz et al. (2014) found that local ballot measures were approved in counties with significantly more threatened and endangered species. Using a base budget scenario, Kroetz et al. (2014) also found that if local ballot measure funding and land preservation were accounted for by a top-down conservation planner working over national scales, the budget could be reduced by 45% to protect the same number of species or, alternatively, the same budget could protect 14% more species.

Although promising, it is important to understand that these conservation benefits of ballot protected areas were resolved to the county level, not individual protected areas in the Kroetz et al. (2014) study. At the county level an unrealistic assumption is made that all species in the county are protected by all local ballot protected areas within that county. The efficiency gains reported by Kroetz et al. (2014) assumes that the quality of ballot protected areas, and subsequently the benefit they provide, is equivalent to other types of protected areas (e.g., ecological reserves, wildlife management areas, wilderness areas, etc.). However, quality differences between protected area types can arise from the unequal distribution of habitats and species across a county and also from characteristics specific to individual protected areas. These include physical characteristics (e.g., size, shape), proximity to other protected areas, management (allowed vs. prohibited uses, legal mandates), governance (i.e. public vs. private responsibility), and threats (both biological and anthropogenic) (Barnes, Craigie, Dudley, & Hockings, 2016).

This thesis presents the first parcel-grain analysis of the contribution of protected areas established through local ballots to biodiversity conservation. It compares the network of ballot protected areas to networks of protected areas established by other conservation actors to assess if ballot protected areas fill gaps in the protected lands space. This chapter focuses on locational characteristics of ballot protected areas. It answers the question: how well positioned geographically is the network of protected areas established through local ballot measures to provide protection to habitats and species when compared to a network of protected areas established by other conservation actors?

There are many ways by which protected areas can be evaluated (Gaston, Jackson, Cantu-Salazar, & Cruz-Pinon, 2008). Examining whether protected areas are located in places that would "cover" important biodiversity features like in this chapter is one common approach. This approach is often referred to as a gap analysis (Jennings, 2000; Scott et al., 1993) and assumes a minimal standard of protected area performance, basically that a protected area needs to be located somewhere near to a species or habitat if it is to protect it. The separate but important issue of whether sites are of a suitable quality to provide protection benefits is addressed in the next chapter. Interest in whether protected areas were geographically located in places that could provide protection to a representative sample of biodiversity stems from historical biases in where protected areas were sited. Representativeness can be taken to mean a few different things in the sense of conserving biodiversity (Kukkala & Moilanen, 2013), but here it is meant in the sense of Austin & Margules (1986) to be when a selection of protected areas contains the full variation of biota in a region or system. Historic ad hoc siting of protected areas resulted in the protection of lands that "nobody wanted"; they were not of economic value (e.g. for farming, forestry, mining) or were remote from densely populated areas (Joppa & Pfaff, 2009; Pressey, 1994). The result was a protected area system that was not located in places that could provide protection to the full complement of species and habitats (Pressey, 1994).

Particularly relevant to the approach that we take in this chapter are studies that compare two different types of protected area in terms of how well they are located to provide benefits to biodiversity. Holmes (2013) provides examples of private protected areas being sited in places that allow them to offset biases in public protected areas. In one such example, Gallo et al. (2009) found an increase in conservation target achievement in the Little Karoo region of South Africa when accounting for both public and private protected areas, specifically for resources that are more endangered. Our emphasis here is not on public vs. private protected areas, but we take a similar approach in comparing how well protected areas established in different ways are located to provide benefits to different aspects of biodiversity.

METHODS

Study system

The analysis of the conservation benefits conferred by different types of protected area networks, hereafter PA networks, was restricted to all 58 counties in the state of California in the United States. California was selected as a case study because it supports a great number of imperiled and endemic species (Stein & Kutner, 2000), is a major area for conservation spending by different public and private actors (Fishburn, Boyer, Kareiva, Gaston, & Armsworth, 2013; Underwood, Klausmeyer, Morrison, Bode, & Shaw, 2009), and the prevalence (108 from 1988-2014 (Trust for Public Land, 2018)) and research of ballot measures in the state (Gerber & Phillips, 2005; Kahn & Matsusaka, 1997; Matsusaka, 2005).

Ballot protected areas, the PA network type of interest, represent a large amount of funding cumulatively, but the area over which the funds can be used is restricted geographically to the political jurisdiction of the ballots themselves. From 1988-2014, over USD$4 billion was allocated for conservation in 16 counties from county, municipal, and special district jurisdictions (Trust for Public Land, 2018). Ballot protected areas were compared to two other institutional conservation actors that are able to allocate funding widely across the entire state; one a public, state-level conservation agency and the other a private, state-level conservation organization.

The public agency used was the California Department of Fish and Wildlife (CDFW) whose mission “is to manage California's diverse fish, wildlife, and plant resources, and the habitats upon which they depend, for their ecological values and for their use and enjoyment by the public” (California Department of Fish and Wildlife, 2016b). As of July 2017, CDFW maintained 720 properties, including 103 designated wildlife areas and 87 designated ecological reserves, managing and administering a total of 459,395 hectares (California Department of Fish and Wildlife, 2017). From 1947-2007, CDFW spent approximately USD$2.2 billion for the acquisition, restoration, and public access of over 600,000 hectares (Wildlife Conservation Board, 2008). Use on CDFW lands include hiking, camping, hunting of various game species, fishing, horseback riding, and bicycling (California Department of Fish and Wildlife, 2016a). Horseback riding is prohibited from some lands and minimally restricted on others. Bicycling on CDFW lands is restricted to nine wildlife areas, often to specific units and during specific portions of the calendar year.

The private organization was The Nature Conservancy California (TNC) whose mission is “to conserve the lands and waters on which all life depends” (The Nature Conservancy, 2016). In the coterminous United States, TNC has protected an area of land equivalent to more than half of the area of the National Park system (Fishburn et al., 2013). Investments in land protection in California in recent decades have exceeded $200 million, protecting over 100,000 hectares (Armsworth, unpublished data). The differences in distribution of the three PA network types can be seen in Figure 1.

Data

Protected area networks

Parcels preserved by funding from successful county, municipal, and special district ballot measures in California were identified by the respective jurisdictions. First, the jurisdictions with successful ballot measures were obtained from The Trust for Public Land's LandVote Database and Ballotpedia's database on local ballot measures (Ballotpedia, 2014; Trust for Public Land, 2016). Requests for data linking preserved parcels to specific ballot measures were made to the entities within those jurisdictions authorized to use the funds allocated by the successful measures. Of 16 counties that passed such measures between 1988 and 2014 (see Figure 1 inset), 10 predominantly coastal counties provided the requested data for a total of 730 parcels. Six counties that were contacted were unable and/or unwilling to provide the requested data, but presumably preserved land with funding from successful ballot measures. The CDFW PA network (n = 3303) was extracted as all parcels that attributed CDFW as the agency owning or managing a parcel from the California Protected Area Database (CPAD) version 2014a, and extends through 55 counties (GreenInfo Network, 2014). TNC provided GIS data for 444 parcels they had established in California (The Nature Conservancy, 2017). Prior to analysis, 143 parcels were removed from the TNC dataset because they were indicated to have been transferred and a small subset overlapped with CPAD CDFW parcels. The total number of TNC parcels used was 301.

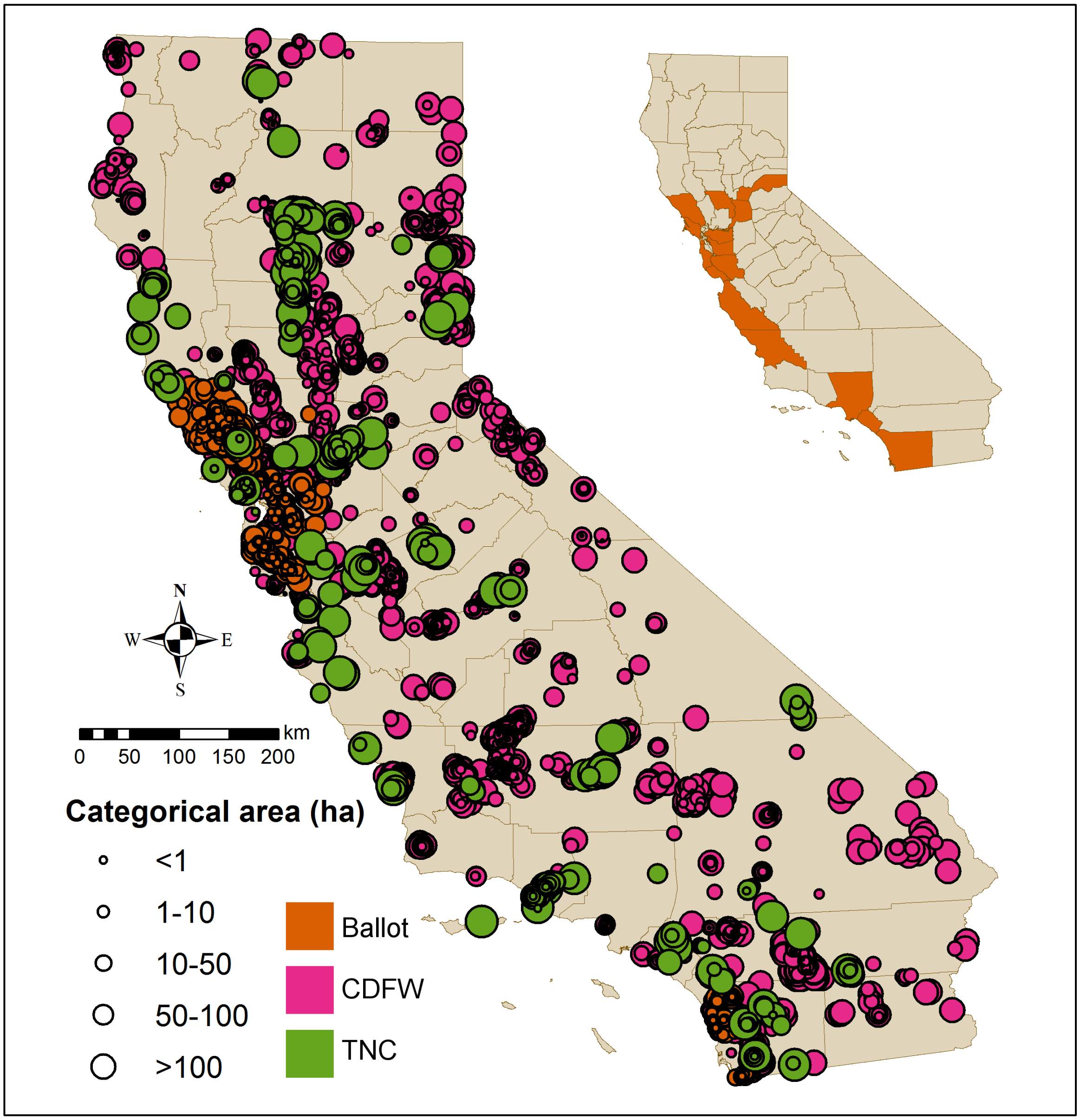

Figure 1. Distribution of three protected area types in California: one funded and managed at the local level (Ballot) and two at the state level (CDFW, TNC).

Inset map highlights counties in which county, municipal, and/or special district ballot measures that allocated funds for conservation successfully passed.

Land cover and vegetated habitat types

Our coarsest biodiversity classification was of major land cover types; if some land cover type goes unprotected then any species restricted to that land cover type will also not receive protection. Land cover data used was from the 2011 National Land Cover Database (Homer et al., 2015). This categorically coarser data defines 16 land cover subclasses in eight broader cover classes (e.g., water, developed, barren, forest, shrub, herbaceous, planted/cultivated, wetlands) at 30-m resolution (Appendix Table 10).

We also examined how well the different types of protected area performed at providing protection to different vegetated habitat types, a more resolved classification.
The vegetated habitat types, hereafter habitat types, dataset was the habitat categories CDFW developed for their California Wildlife Habitat Relationship (CWHR) model (California Department of Fish and Wildlife, 2014). It includes spatial data for 58 habitat types within six broad categories: tree dominated, shrub dominated, herbaceous dominated, aquatic, developed, and non-vegetated (Appendix Table 11) reported as range maps of potential occurrence within the state. The CWHR habitat categories were specifically developed for a predictive occurrence model of terrestrial vertebrate wildlife species in the state of California.

Species

To examine whether protected areas established in different ways are situated in locations where they can provide protection to species, we looked at overlap with species distributions. Species distribution data is from the same CDFW CWHR model. The dataset contains the range maps of 709 terrestrial, regularly occurring vertebrate species within four classes: 71 amphibians, 368 birds, 182 mammal, and 88 reptiles (Appendix Table 12). The version of the data accessed in March 2015 originally contained 710 species, but data attributed to gray wolf was determined erroneous from communication with CDFW Biogeographic Data Branch staff and removed prior to analysis (Melanie Gogol-Prokurat, personal communication, February 16, 2017).

Analyses

ArcMap 10.1 SP1 (ESRI, 2012) was used to overlay the land cover, habitat type, and species data (i.e. biodiversity features) with each PA network. The resulting clip by each PA network represented the total areal coverage of the biodiversity feature in each PA network. These areas were divided by the total area of each PA network and multiplied by 100 to give the percentage of a PA network that represents each land cover class, habitat type, and species range.

Prior to analysis, all percentages were natural log transformed to approximate normal distributions. For land cover, the land cover class perennial ice/snow had 0% coverage on all three PA networks and was corrected prior to transformation by adding a constant: 1/10 of the smallest non-zero value in each PA network.

Area-based statistics

The percent coverage of biodiversity features for each PA network was plotted against the statewide percent coverage. If the biodiversity features in a PA network are similar in proportion to how much is found in California (i.e. representative of land covers, habitat type, and species in the state), then a best fit line through the resulting data-points would be similar to a 1:1 line (Figure 2b). If a conservation organization is successfully targeting protection towards more geographically restricted species, habitats or land covers then the slope of a best fit line would be less steep than a 1:1 line (Figure 2a). If a conservation organization is protecting towards species having large geographic ranges, habitats or land covers then the slope of a best fine line would be steeper than a 1:1 line (Figure 2c). This logic provided our primary test statistic. A simple linear regression was used to determine the line of best fit for each PA network. Using the parametric, two-tailed Wald test (Zuur, Ieno, & Smith, 2007), the slope of the line of best fit was tested for a difference from 1.

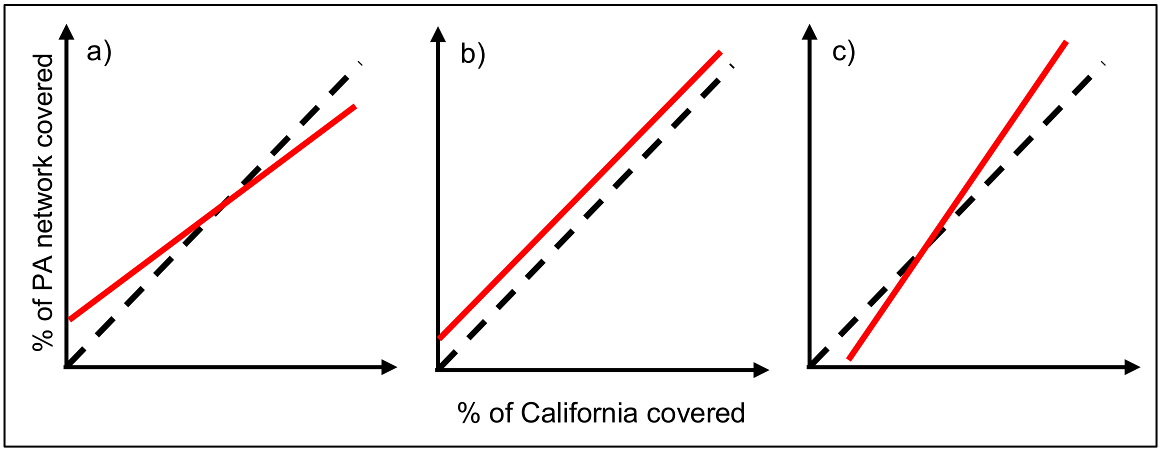

Figure 2. Schematic of different regression coefficients.

Regression line (solid, red) for different slope coefficients. Panel a) where $b_1 < 1$, shows rare features are overrepresented in the PA network. Panel b) where $b_1 = 1$, shows all features are represented equal to the statewide proportions. Panel C where $b_1 < 1$, shows common features are overrepresented in PA network. The 1:1 line (black, dashed) represents if the values for the PA network exactly matched the values over the entire state.

Occurrence-based statistics

While this regression approach provides our primary test statistic, some of the relevant datasets are characterized by a large number of zeroes (e.g., when one species range does not overlap a particular protected area type). Because of the number of zero values for habitat types and species ranges, the analysis of the data was partitioned instead of just adjusting the data by adding a small constant as was done for land cover. For habitat types, only the ballot protected network contained zeros whereas all PA networks contained some zeros in all vertebrate class species ranges. For each PA network, species ranges and habitat types were first scored as either being within the PA network (i.e. protected) or not being within the PA network (i.e. not protected). Hereafter common and rare will be used in place of geographically common and geographically rare.

For statistical testing, we needed a null model against which to compare coverage of species and habitats (somewhat akin to the use of the 1:1 line in the regression approach described earlier). To obtain a null expectation for how many species or habitats would be contained in a PA network of given size, we generated 100 random networks for each of the three PA types. Each random network was made of randomly sampled points within the bounds of California equal to the number of parcels within each observed PA network type. Random points were buffered with a randomly paired area from the parcel size distribution of each PA network and verified to not overlap with another buffered point nor the boundaries of California. Each random network was processed in ArcMap and each species range and habitat type were scored as being protected or not protected by the random PA network as described previously.

Because the data did not approximate a normal distribution, even after transforming, the non-parametric Mann-Whitney-Wilcoxon rank test (Mann & Whitney, 1947; Wilcoxon, 1945) in the statistical program R 3.5.0 (R Core Team, 2018) was used to test for a difference in the distributions of the expected and observed percent coverage of each PA network. All data met the assumption of equal variance between observed and expected with the exception of the amphibian species ranges for the ballot PA network (F = 1.885, df_{num} = 24, df_{den} = 70, p = 0.04271). Therefore, results pertaining to amphibian species for the ballot PA network should be interpreted with caution.

RESULTS

Land cover

Of the 16 possible subclasses, the three most abundant land covers in the state of California were shrub/scrub, evergreen forest, and grassland/herbaceous respectively (Table 1). Evergreen forest, grassland/herbaceous, and mixed forest were the classes most contained within the ballot PA network. Shrub/scrub, grassland/herbaceous, and emergent herbaceous wetlands were the most contained within the CDFW network. The most contained land cover classes in the TNC network were the same as for the entire state, but the ranks were not; grassland/herbaceous followed by shrub/scrub and evergreen forest. None of the PA networks examined contained the land cover class perennial ice/snow as that class was restricted to the high elevations of the Klamath Mountains and Cascade Range in the north as well as the high elevations of the central Sierra Nevada, and is likely well-covered by existing federal lands. None of the three PA networks examined protected land cover proportionally different than they occur across the entire state of California; i.e., the slopes of the relevant regression lines were not significantly different from 1 (Figure 3, Table 2). In other words, we did not find evidence that the ballot PA network was any less effective at covering land cover than the CDFW and TNC networks.

Table 1. Percentage coverage by protected area type for NLCD 2011 land cover.

NLCD land cover subclass value	Land cover description	CA	Ballot	CDFW	TNC
11	Open Water	1.24	0.38	4.83	0.40
12	Perennial Ice/Snow	0.01	0.00	0.00	0.00
21	Developed, Open Space	3.00	3.05	1.94	1.24
22	Developed, Low Intensity	1.57	0.39	0.53	0.10
23	Developed, Medium Intensity	1.73	0.10	0.15	0.02
24	Developed High Intensity	0.46	0.00	0.02	0.00
31	Barren Land (Rock/Sand/Clay)	4.97	0.04	3.26	0.44
41	Deciduous Forest	0.86	1.53	0.89	1.04
42	Evergreen Forest	20.01	33.55	5.58	12.30
43	Mixed Forest	2.46	17.73	1.21	6.38
52	Shrub/Scrub	39.99	17.27	42.93	23.99
71	Grassland/Herbaceous	12.85	22.48	20.66	47.35
81	Pasture/Hay	1.85	0.22	2.62	0.35
82	Cultivated Crops	8.15	2.57	6.15	5.03
90	Woody Wetlands	0.25	0.30	1.49	0.67
95	Emergent Herbaceous Wetlands	0.58	0.38	7.74	0.70

**Columns may not sum to 100% due to rounding.*

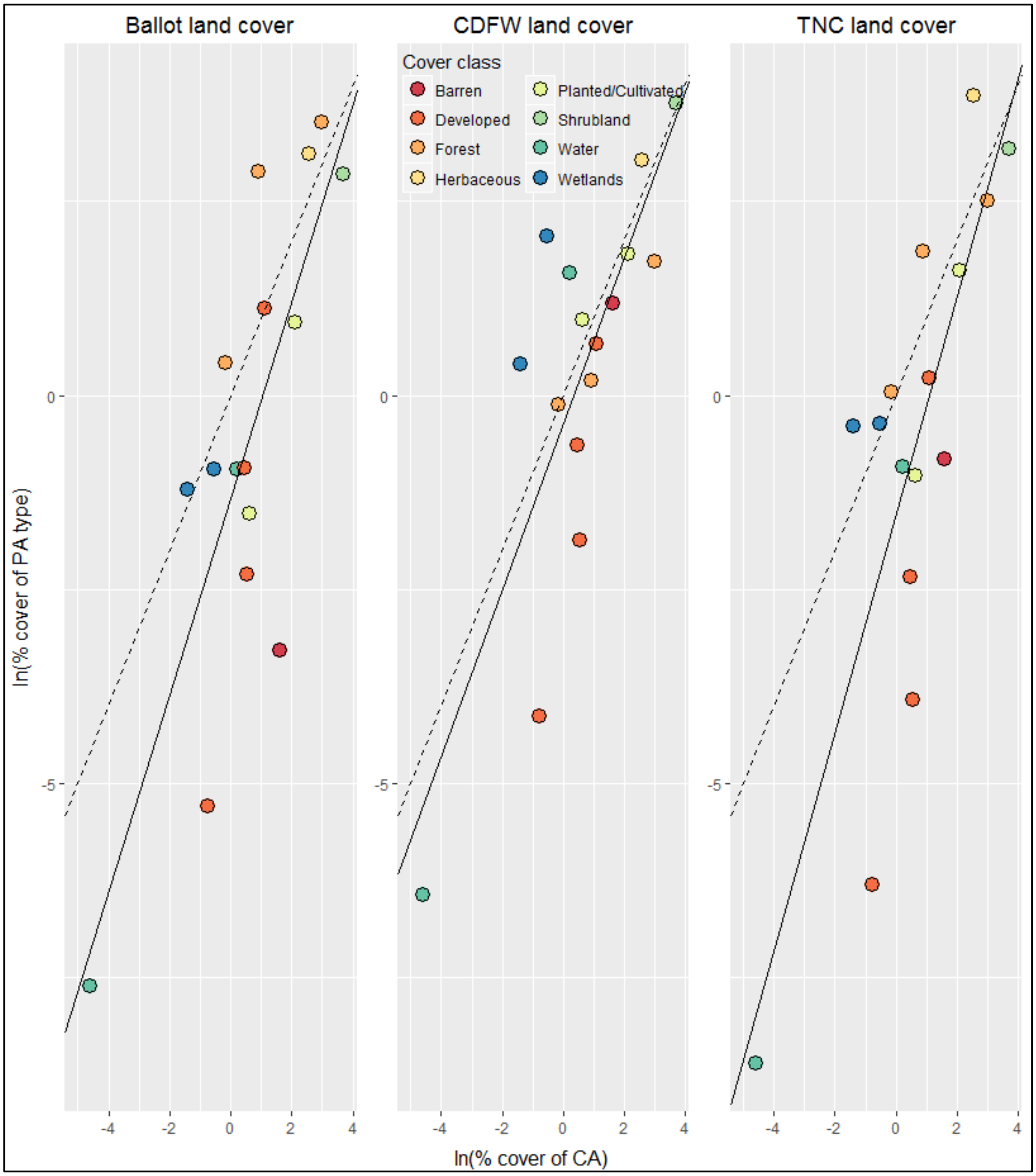

Figure 3. Scatter plots of NLCD 2011 land cover percent coverage by protected area type.

Solid black line is line of best fit. Dashed line is the 1:1 line for reference. All values were natural log transformed.

Table 2. Regression table by protected area type for NLCD 2011 log transformed percent coverage.

PA type	r^2	b_1	Pr(>|t|), b1 ≠ 1
Ballot	0.647	1.271	0.298
CDFW	0.657	1.070	0.741
TNC	0.680	1.402	0.140

Habitat types

When moving to consider coverage of our more resolved vegetated habitat classes, seven habitat types had a range covering all of California and resulted in full coverage by all three PA networks: annual grassland, perennial grassland, fresh emergent wetland, riverine, lacustrine, urban, and barren (Appendix Table 13). Of the 39 habitat types protected in the ballot PA network, aside from those seven aforementioned, the three with the next highest coverage was for three tree dominated habitat types: valley foothills riparian, montane riparian, and coastal oak woodland. Valley foothill riparian, juniper (tree dominated), and mixed chaparral (shrub dominated) were the habitat types most covered by the CDFW network. For the TNC PA network, valley foothill riparian, mixed chaparral, and montane hardwood (tree dominated) were the most covered.

Because some habitat types were not protected in the ballot PA network, we first scored PA networks based only on the number of habitat types they contained and the number that they did not overlap at all. We compared the frequency of missing habitat types to what would be expected based on a network of randomly sited protected areas of the same overall area. Ballot protected areas contained as many habitat types as would be expected at random for a protected area network of their size (Figure 4, Table 3). In the simulated PA networks for CDFW and TNC, all habitat types were present leading to no difference between observed and expected for those networks.

When focusing on the overall area of each habitat type being protected (and omitting those receiving no protection in the ballot PAs), none of the PA networks protect habitat types proportionally different than they occur across California (Figure 5, Table 4). Put another way, we did not find evidence that the ballot PA network was any less effective at covering habitat types than the CDFW and TNC networks.

Species

For species, as with habitat types, many were not protected in all of the PA networks. Again, we first scored the PA networks based only on if a species was contained or not contained within the PA networks. The frequency of species missing from each class of vertebrates was compared to what would be expected based on a similarly sized network of randomly sited protected areas. In the ballot PA network significantly more common bird, mammal, and reptile species were protected than would be expected in the random ballot PA network of the same overall area (Table 5). Significantly more common amphibians were protected by the TNC network. A significant difference was detected for more common amphibians in the ballot PA network, but those data did not meet the assumptions of the statistical test used. No difference was detected for the observed and expected levels of protection for species in any class in the CDFW PA network (Figure 6, Table 5).

Table 3. Mann-Whitney-Wilcoxon rank test results for observed and expected habitat type protection in the ballot protected area network.

PA type	$\tilde{x}\%_{obs}$	n_{obs}	$\tilde{x}\%_{exp}$	n_{exp}	W	*P*
Ballot	22.436	39	17.610	58	952.5	0.190

Table 4. Regression table statistics by protected area type for CDFW CWHR habitat type log transformed percent coverage.

PA type	r^2	b_1	n	Pr(>|t|), b1 ≠ 1
Ballot	0.284	1.086	39	0.763
CDFW	0.502	0.885	58	0.335
TNC	0.334	1.053	58	0.789

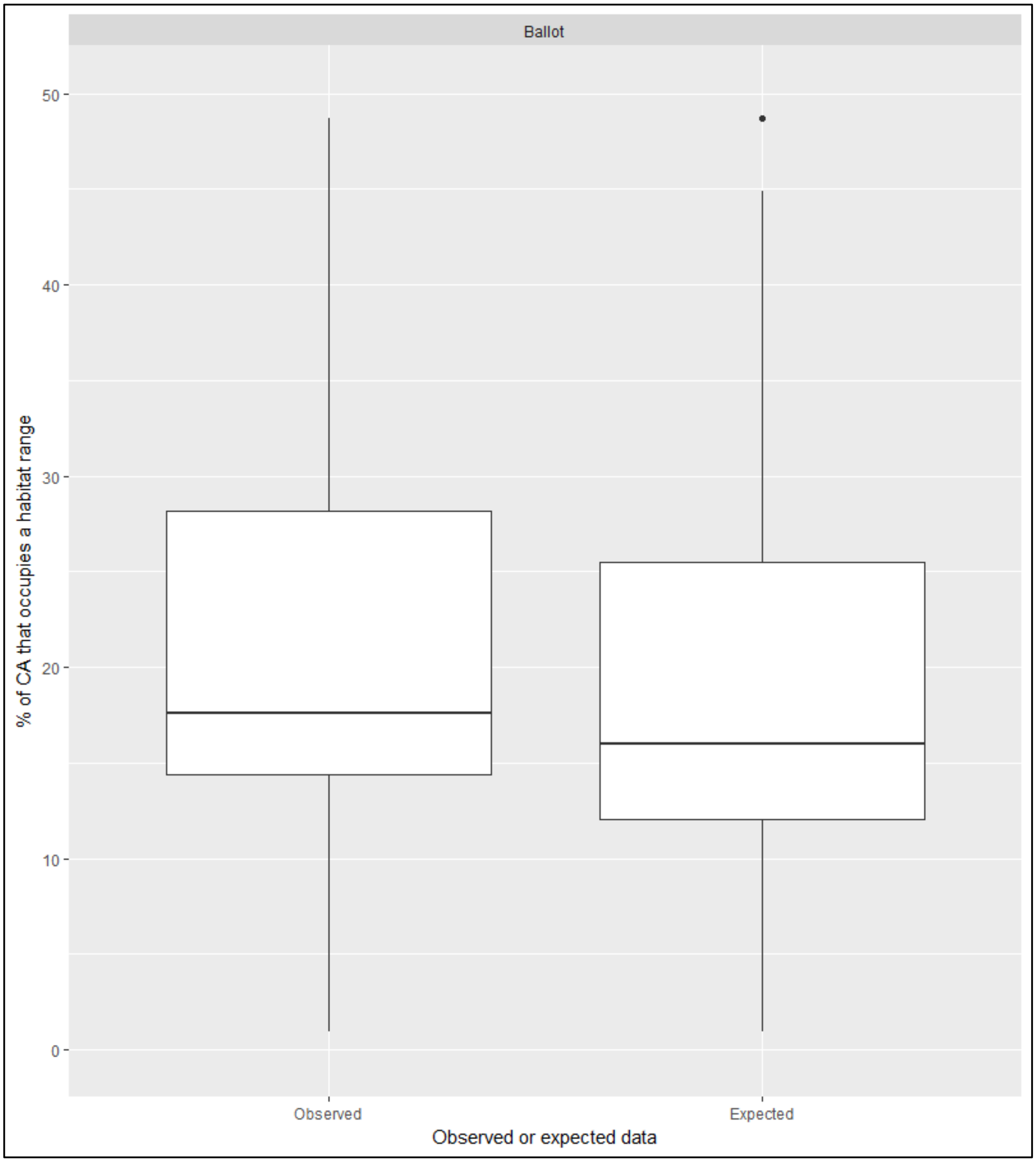

Figure 4. Distribution of habitat type range size for observed and expected ballot protected area networks.

The distribution of habitat types within the observed ballot PA network (left), i.e. those protected, and those that would be expected to occur within a random ballot PA network (right) by the habitat types' range size in California.

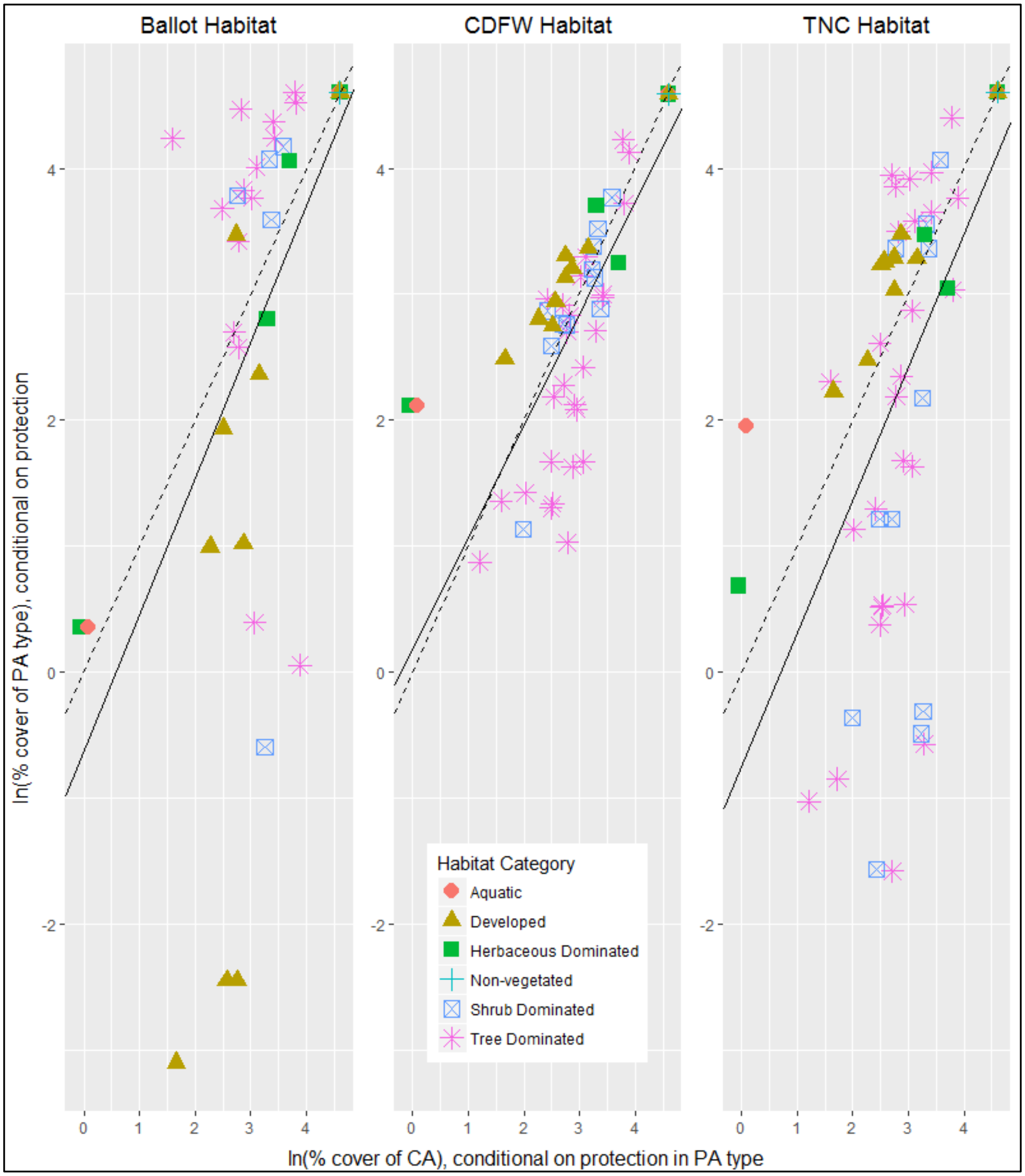

Figure 5. Scatter plots of CDFW CWHR habitat type percent coverage by protected area type.

Solid black line is line of best fit. Dashed line is the 1:1 line for reference. All values were natural log transformed.

Table 5. Mann-Whitney-Wilcoxon rank test results for observed and expected species protection by class in all protected area networks.

Taxa class		$\tilde{x}\%_{obs}$	n_{obs}	$\tilde{x}\%_{exp}$	n_{exp}	W	*p*
Amphibians							
	Ballot	14.266	25	2.042	71	411.5	7.19E-05***
	CDFW	2.546	62	2.042	71	1960	0.278
	TNC	5.446	44	2.042	71	1106	0.00876*
Birds							
	Ballot	45.163	281	31.267	366	42129.5	8.03E-05***
	CDFW	31.512	362	30.836	368	65565	0.714
	TNC	33.537	345	31.267	366	60307.5	0.302
Mammals							
	Ballot	33.973	96	15.659	182	5998	1.75E-05***
	CDFW	16.044	178	15.659	182	15893	0.0758
	TNC	20.520	151	15.731	182	11976.5	0.0525
Reptiles							
	Ballot	30.574	43	20.002	88	1265.5	0.00215*
	CDFW	21.452	85	20.002	88	3612.5	0.700
	TNC	24.311	71	20.002	88	2585.5	0.0623

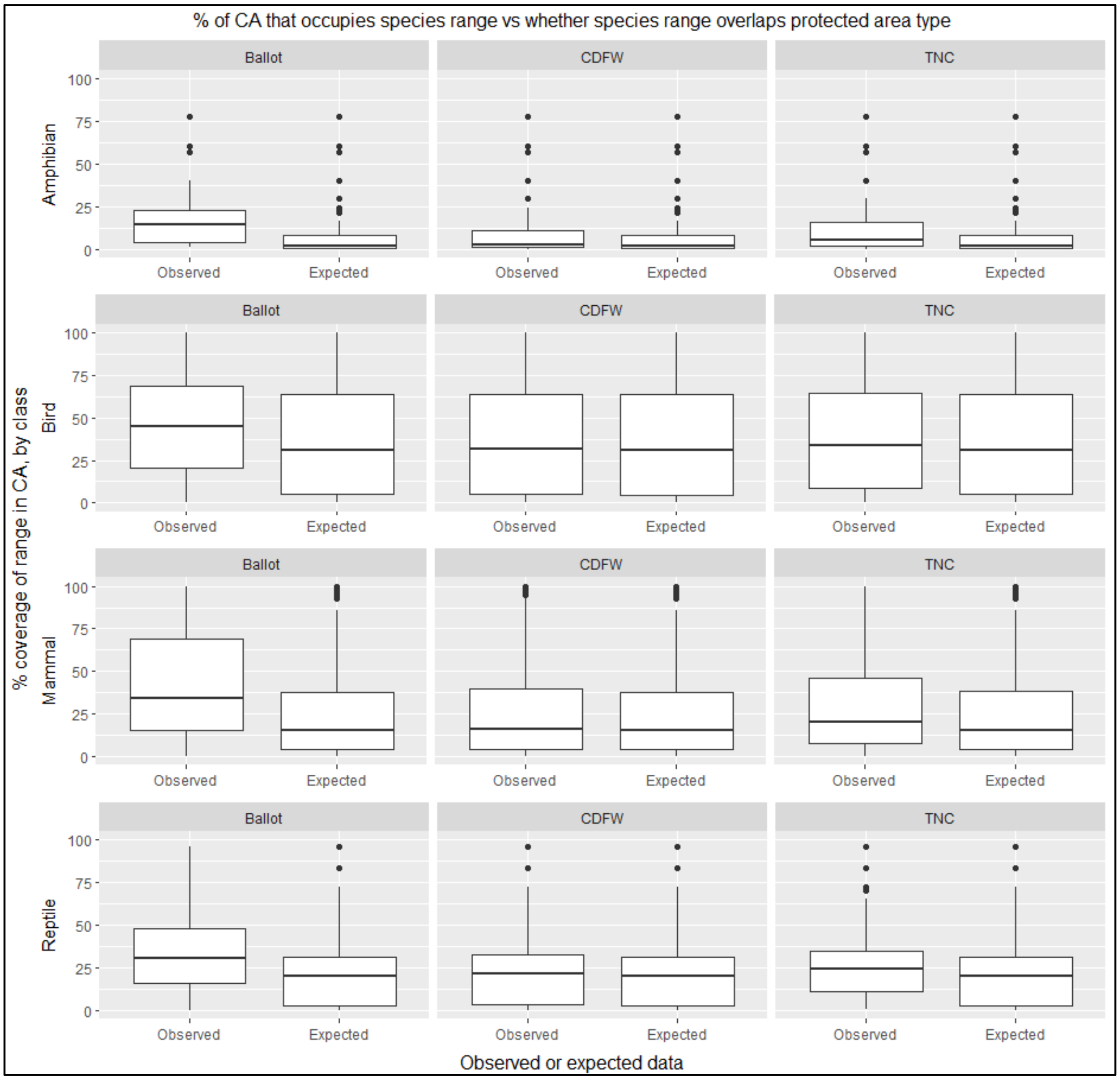

Figure 6. Distribution of species range size by class for observed and expected protected area networks.

The distribution of species within the observed PA network (left), i.e. those protected, and those that would be expected to occur within a random PA network (right) by the species' range size in California.

When we excluded species not protected in a PA network and shifted focus to the overall area of each species range being protected, we see differences in the proportional representation of species among networks. Of the species protected in the ballot PA network, rare mammals and common bird species are significantly overrepresented (Table 6). The ballot PA network covered nearly 53% of mammals and 76% of bird species. The CDFW PA network significantly overrepresented rare birds and common amphibian species with 98% of birds and 83% of amphibian species covered. No difference was detected for any class of species in the TNC PA network from the representation in California (i.e., the slope of the regression lines was not significantly different from 1). Additionally, no difference was detected in any PA network for reptile species. This means there was effectively no difference in the protection of the reptiles present in any of the PA networks from what would be expected at random (Figure 7**,** Table 6).

Table 6. Regression table by vertebrate taxa class and protected area type for CDFW CWHR species ranges log transformed percent coverage.

Taxa class		r^2	b_1	n	Pr(>|t|), b1 ≠ 1
Amphibians					
	Ballot	0.400	1.177	25	0.562
	CDFW	0.781	1.444	62	3.19E-05***
	TNC	0.457	0.943	44	0.722
Birds					
	Ballot	0.628	1.354	281	3.47E-08***
	CDFW	0.880	0.849	362	4.95E-18***
	TNC	0.581	0.966	345	0.438
Mammals					
	Ballot	0.380	0.773	96	2.79E-02*
	CDFW	0.775	1.003	178	0.940
	TNC	0.511	1.024	151	0.767
Reptiles					
	Ballot	0.413	1.004	43	0.984
	CDFW	0.602	0.916	85	0.308
	TNC	0.465	1.179	71	0.243

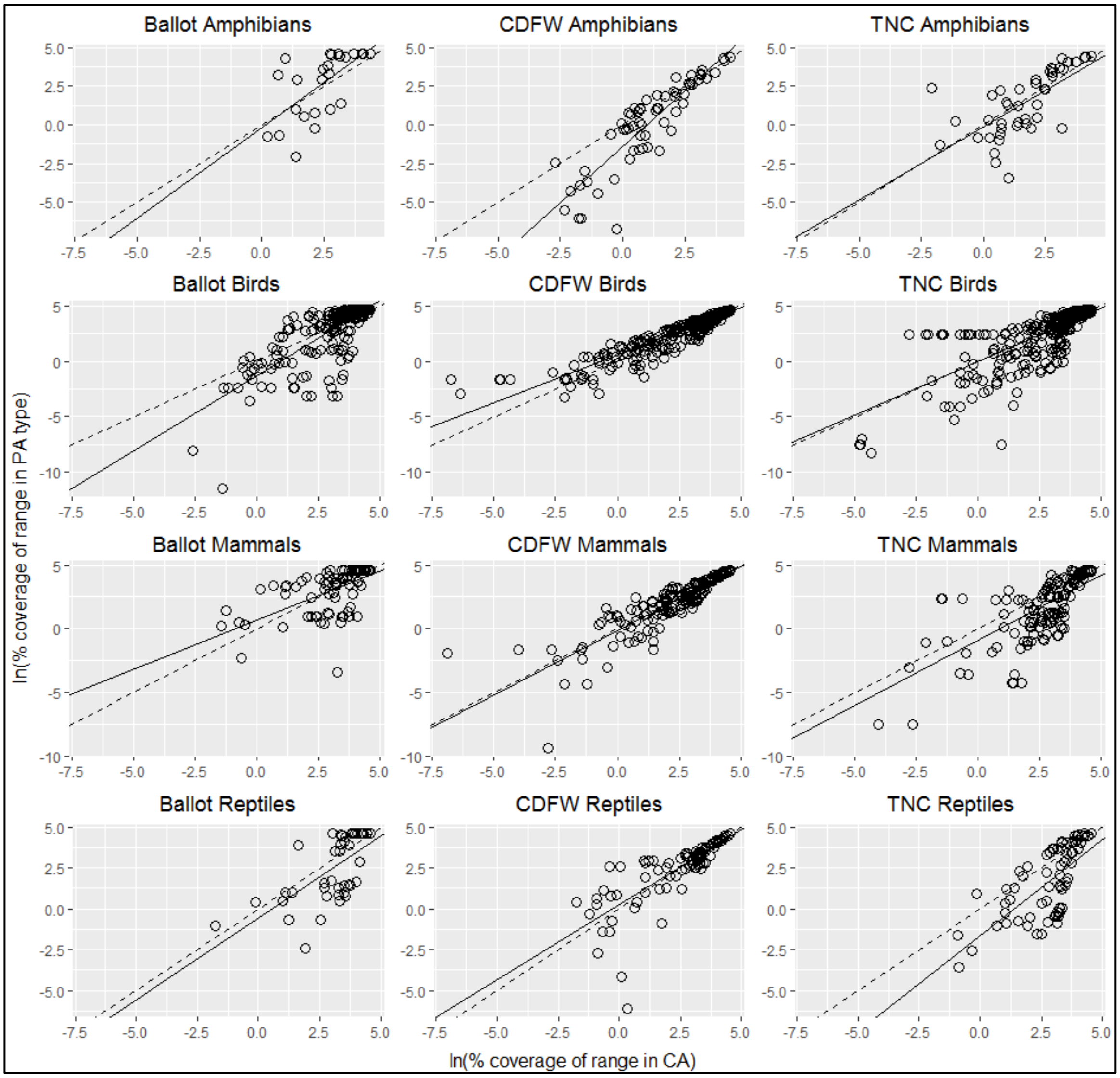

Figure 7. Scatter plots of CDFW CWHR habitat type percent coverage by protected area type.

Solid black line is line of best fit. Dashed line is the 1:1 line for reference. All values were natural log transformed.

DISCUSSION

This paper presented the first parcel-grain analysis of conservation contribution from protected areas funded by local ballot measures. The network formed by this bottom-up conservation was compared to protected area networks established by two top-down conservation actors. The networks were evaluated for how well they represented biodiversity features in the state of California. We found that the ballot PA network performs comparably to the two top-down PA networks in terms of proportional representation of biodiversity features in California, while obviously being smaller in overall size. That being said, just how well each of the PA networks performs at representing biodiversity features depends on the particular biodiversity features examined.

The ballot PA network appears to contribute to biodiversity conservation despite its geographically restricted nature (Figure 1) when compared to the top-down networks of CDFW and TNC. For a network of its size, the ballot PA network appeared to perform as well as the top-down networks in representing land cover (Table 2) and habitat types, both when evaluating based on occurrence (Table 3) and area protected (Table 4). However, it is worth noting that none of the networks performed better at representing rare habitats and land cover types than would be expected based on random siting of protected areas. Our finding that none of the three protected area networks is preferentially protecting rarer habitats or land cover types matches findings from previous work evaluating the proportional representation in PA networks. For example, Kuempel, Chauvenet, & Possingham (2016) found that observed protection equality (see Barr et al., 2011) of ecoregions by protected areas within countries were no different than the protection equality from simulated random allocations of protected areas in the same countries.

Closer inspection of PA network coverage at the species level reveals that the ballot PA network protects more common species when assessed for species presence (Table 5). However, species protection assessed by range size for those species found somewhere within the PA network showed more nuanced results (Table 6). Specifically, the ballot PA network protected rarer mammals but more common bird species than would be expected based on randomly siting PAs. Therefore, what one would conclude about how effectively ballot PAs protect species would depend both on the taxonomic group considered and how protection is defined. The distinction being drawn here between scoring protection based on occurrences of species versus hectares of range protected reflects wider discussions in conservation planning writings over the importance of how protection goals are defined (see Cabeza & Moilanen (2001) for examples of different protection goal definitions and their outcomes for species coverage). More recent work by Di Fonzo et al. (2016) shows that variation in species protection exists along a spectrum of a single protection goal.

While not the primary goal of this analysis, it is also worth noting how well the two top-down networks perform in terms of contributing to the conservation of biodiversity. CDFW and TNC PA networks were both statistically no different in their protection of land cover and habitat types from what would be expected just based on the area of each habitat type found in the state (Table 2**,** Table 4). As with the ballot PA network, how well either top-down PA network performed at providing protection to species depended on the use of species presence or species ranges conditional on presence for scoring conservation performance and on the focal taxonomic group considered (Table 5**,** Table 6). A distinction is often drawn in the literature between private conservation actors and public agencies active in conservation. One of our top-down actors is private (TNC) and one is a public agency (CDFW). Yet we do not find a strong signal that either is doing lots better than the other or than would be expected based on random siting of protected areas in terms of representing species, habitats or different land covers. This contrasts with findings by Gallo et al. (2009) in the biodiversity hotspots of the Cape Floristic

Region in South Africa. Private conservation actors in that region better represented lower elevation and endangered habitats than the public conservation actors.

We obviously made various choices in how we designed our analyses, and while we feel these are justified, other assumptions would also have made sense. In addition, there are obvious important extensions of our work. For example, two of the three biodiversity related datasets used in this analysis came from the California Department of Fish & Wildlife California Wildlife Habitat Relationships model. Using this data while also evaluating the coverage of the CDFW PA network may have led to an increased coverage detected for the network. This may explain why across all vertebrate classes, the CDFW PA network had the fewest number of species missing from its network. Future development of this approach would be advantaged to use a dataset with a spatial coverage at a wider scale (e.g. NatureServe data for all of the United States). The uniformity of a national dataset would allow for comparison of ballot PA networks from different states (e.g. Florida, New Jersey) and determination of trends across bottom-up conservation. While the results of this GIS-based analysis suggests that the ballot PA network can make a meaningful contribution to biodiversity protection, it raises the question of quality differences between the sites that make up each network, providing an obvious extension of these results. Ecological condition is likely affected by site differences (e.g. allowed uses on site) that must be assessed to determine the degree to which contributions to biodiversity protection are realized. We begin to address this important extension in Chapter 2.

We have demonstrated that geographic constraints that necessarily apply to bottom-up conservation efforts, here exemplified by ballot protected areas, need not preclude these local efforts from doing as good of a job at representing biodiversity as protection efforts promoted by top-down conservation actors with more freedom to choose where to protect. Rather than duplicate efforts, top-down conservation actors should evaluate how best to complement the efforts of local groups perhaps by prioritizing locations receiving less local support.

CHAPTER II

THE IMPACT OF RECREATIONAL USE AND ACCESS ON THE ECOLOGICAL CONDITION OF PROTECTED AREAS

A version of this chapter will be submitted for publication by Chad M. Stachowiak and Paul R. Armsworth:

Chad M. Stachowiak and Paul R. Armsworth (XXXX). The impact of recreational use and access on the ecological condition of protected areas. Conservation Biology xx: xxx-xxx.

Chad Stachowiak developed the idea for this manuscript, conducted the analysis, and wrote the manuscript. Paul Armsworth is a co-author of this work and was responsible for feedback at early stages of this manuscript's development and helping with editing.

ABSTRACT

Because funding shortfalls prevent meeting conservation targets, one partial solution is for conservation organizations to account for other forms of conservation. However before other forms of conservation can be included, the quality of the benefit provided must be confirmed. Here, we show how the condition of protected areas funded through action by local communities at the ballot box compares to protected areas funded by a state public agency with respect to the coverage by exotic species in the state of California. We then show if properties of the protected areas or human-mediated onsite disturbance are able to predict the coverage by exotic species. We find that exotic species coverage does not differ between protected area types. In our sample, elevation was the only significant predictor of exotic species coverage. This suggests that ballot protected areas are in no lesser condition than a conventional protected area type funded by a state public agency.

INTRODUCTION

Results from Chapter 1 suggest that bottom-up conservation in the form of a ballot protected area (PA) network have the potential to make meaningful contributions to the protection of biodiversity. However what still remains to be answered is whether these sites are in a suitable ecological condition to secure these benefits. Ecological conditions on protected areas can vary greatly depending on how sites are used and managed. Are ballot protected areas in a comparable ecological condition to other types of PA or are they more degraded somehow? If a conservation planner is to account for a ballot PA network, they must understand the trade-offs in the conservation of biodiversity between PA types.

Ballot PAs could differ in the quality because of both extrinsic and intrinsic factors of the PA. For instance, distance to the pool of users in the nearest population center and climate are examples of external factors that would likely influence PA quality. Internal factors include the size of the protected area and the management of the protected area. Specific to ballot PAs, aspects of management are often dictated in the language of the ballot measure that establishes funding for the PA. For example, in a 2008 ballot measure passed by 71% of voters in Alameda and Contra Costa counties, the managing authority, East Bay Regional Park District, is directed to acquire, develop, and improve trails and recreational facilities:

> *"To continue restoring urban creeks, protect wildlife, purchase/save open space, wetlands/shoreline,* ***acquire/develop/improve local and regional parks, trails and recreational facilities****, shall East Bay Regional Park District be authorized to issue up to $500 million in general obligation bonds, provided repayment projections, verified by independent auditors, demonstrate that property tax rates will not increase beyond present rates of $10 per year, per $100,000 of assessed valuation?"*

Ballot protected parcels are likely to see more recreational use than would a more isolated protected area and recreational use can impact ecological conditions on protected areas. Different forms of recreational activity have been documented modifying the habitat for flora and fauna on the lands that it occurs. Recreation in PAs is also thought to have an asymptotic curvilinear relationship with ecological condition (Hammitt, Cole, & Monz, 2015). In other words, the ecological impact per recreational visitor is greatest at lower levels of recreation but the overall ecological impact saturates at high visitation rates. Yet the relationship varies by the type of recreation and the specific conditions of the PA (Monz, Pickering, & Hadwen, 2013). Mixed results have been reported in studies examining the effect of hiking in PAs on different animal groups; reductions in the abundance of native mammalian carnivores (Reed & Merenlender, 2008, 2011), abundance of turtles (Garber & Burger, 2016), and density of ground-dwelling birds (Thompson, 2015) have been documented, but so have increases in the abundance of some amphibians (Davis, 2007; Fleming, Mills, Russell, Smith, & Rettig, 2011). Meanwhile Deluca & King (2014) found no effect on the abundance of some montane bird species.

Evidence of detrimental impacts of recreation on plant communities is clearer. Hiking, biking, and horse riding results in trampled vegetation, loss of vegetative cover, soil compaction, and increased soil erosion (Cole & Spildie, 1998; C. M. Pickering, Hill, Newsome, & Leung, 2010; Törn, Tolvanen, Norokorpi, Tervo, & Siikamäki, 2009). Biking trails proved linear features that reduces the barriers for dispersal of exotic species thereby facilitating their spread (Nemec et al., 2011). Likewise, hiking and horse riding can mediate dispersal of exotic species when their seeds are transported on clothing, in horse dung, or in the animals' fur (C. Pickering & Mount, 2010). In addition to the type of recreation, the amount of area exposed to recreation affects the magnitude of the impact. As a result of a scaling relationship, smaller PAs have higher trail density than larger PAs (McKinney, 2005) indicating that a larger proportion of smaller PAs are more accessible for recreation and potential disturbance.

There are many indicators one could use to examine the ecological condition of a protected area. Here I focus on the cover by exotic plant species. Exotic plant species that proliferate have significant impacts on native species and the communities and ecosystems that they invade (Vilà et al., 2011). Impacts include altered geomorphological, biogeochemical, and hydrological cycles (Carey, Blankinship, Eviner, Malmstrom, & Hart, 2017; Macdonald, Loope, Usher, & Hamann, 1989); changes to fire regime frequency and intensity (Macdonald et al., 1989; Pyšek et al., 2012); and reduction in native species (Barrows, Allen, Brooks, & Allen, 2009). However, the magnitude and direction of these impacts varies across studies (Vilà et al., 2011).

Importantly, the degree to which different protected areas are impacted by exotic plant species has been found to vary greatly (G. D. Iacona, Price, & Armsworth, 2014; G. Iacona, Price, & Armsworth, 2016). Various factors have been implicated in why some protected areas are impacted much more by invasive plants than others. For example Iacona et al. (2016) found the presence of invasive plants species in Florida tended to be best predicted by features related to PA ecological characteristics (e.g. elevation, 3-day frost interval) whereas the proportional cover of species tended to be better predicted by features that indicated human disturbance on a PA (e.g. area, density of nearby houses, road density). The direction and significance of the effect varied by species for both cover and presence. Furthermore, disturbance tends to favor the propagation of these species (Hobbs & Huenneke, 1992; Meiners & Pickett, 2013).

This chapter offers a first exploration of whether ballot protected areas are in a comparable ecological condition to protected areas established in other ways. We used cover of exotic plants as an indicator of ecological condition and compared how invaded ballot protected areas were to how invaded were protected areas established by one of the top-down conservation actors featured in Chapter 1. In doing so, we paid particular attention to reasons why ballot sites might differ in quality. Was it because of biophysical properties of sites protected through the ballot or differences in how ballot sites were used for recreation? Specifically, we aim to answer, 1) is there a difference in exotic plant cover between the two PA types, 2) if so, what accounts for these differences, and 3) are measures of recreational use and disturbance in particular predictive of exotic plant cover?

METHODS

Study system

This analysis of the quality differences in PA parcels within ballot and CDFW networks was restricted to 15 counties in and around the San Francisco Bay area of California (Figure 8). This area represented a high density of ballot PAs, which had CDFW PAs located nearby (see Chapter 1 Figure 1).

Twenty-seven parcels of both networks type were visited for data collection. Ballot parcels were managed among 5 different institutions/agencies. CDFW parcels spanned 3 different management regions. Prior to analysis, 2 CDFW parcels were dropped after we learned from a site manager that the management of a parcel in Napa County ended months prior to field data collection and that management of a parcel in Sonoma County only consisted of organizing hunts. Two ballot parcels in San Luis Obispo County were also dropped prior to analysis; one because it was a conservation easement and the other because all required information needed for analysis could not be gather on the parcel. Parcel locations within the study area can be seen in Figure 8.

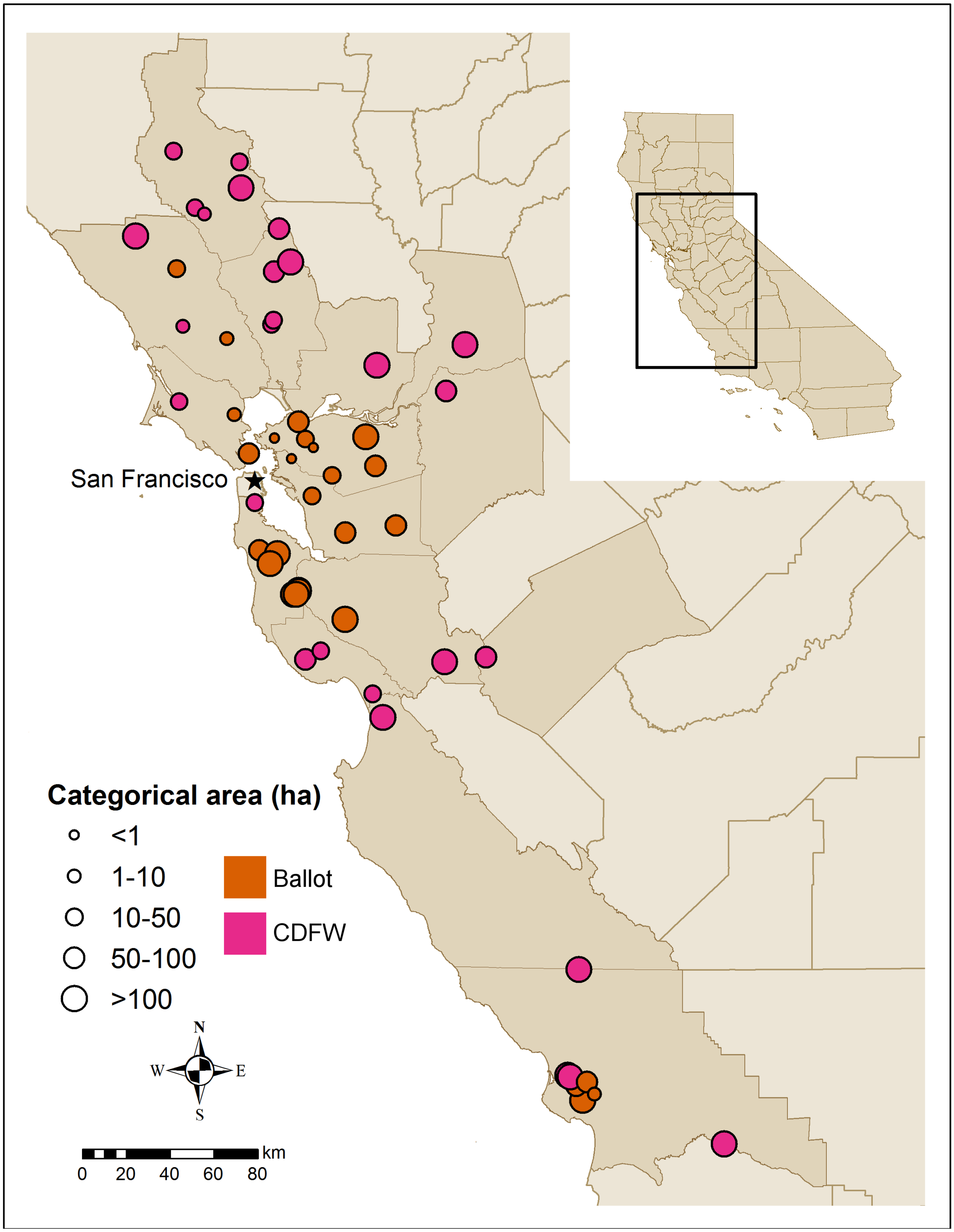

Figure 8. Distribution of PA parcels among counties in area study.

Biotic disturbance

For our indicator of biotic disturbance, we chose exotic plant cover. We focused on one habitat type common to all surveyed parcels: forested with canopy cover. At each parcel, 3 locations were visited for sampling and selected by identifying habitat patches within the parcel that were significantly large to contain three spatially separated sampling points. At each location a 1-meter by 1-meter plot with sides of the plot following cardinal directions was set up. At 100 points in a grid frame spaced 0.1-meters apart, herbaceous plants were identified to species and as native or exotic. The summed number of hits in the grid frame at each of the plots identified as exotic was the response variable for this analysis.

Abiotic disturbance

To determine if physical disturbance to the site impacts biotic disturbance, we chose to quantify two indicators of relative spatial variation in abiotic disturbance among protected areas by recreational users: trail density and the amount of trash found on site. To control for the effect of trails, a representative data layer of "official" recreation trails was compiled from data layers provided by each individual agency/institution and confirmed by managers of the individual parcels. All provided data layers were cross checked with publicly available access maps provided by the agency/institution. If data was not provided for a parcel and trails were present on a publicly available map, trails were digitized in ArcMap 10.1 SP1(ESRI, 2012) using U.S. Department of Agriculture (USDA) National Agriculture Imagery Program (NAIP) imagery from 2014 (USDA Farm Service Agency, 2014) at 1:2,500 scale.

For ballot parcels, recreation trails include those designated for hiking, bicycling, and horse riding as well as service and access roads that did not explicitly prohibit all of those uses and would reasonably be used for those purposes (e.g. a wide, dirt track designated as emergency vehicle access; a wide, dirt firebreak). The majority of trails on ballot parcels were multi-use, allowing all three uses, but a small fraction only permitted hiking-only or hiking and horse riding only. These different use categories were not accounted for in the analysis.

The California Department of Fish and Wildlife employs a policy of diffuse natural resource management (Conrad Jones, personal communication, July 20, 2016) and does not have official recreation trails per se but does allow hiking and horse riding on parts of the land it manages. The only exception in the collection of parcels studied is one parcel owned and managed by CDFW and administered by the National Oceanic and Atmospheric Administration (NOAA), Elkhorn Slough Ecological Reserve/National Estuarine Research Reserve, which contains maintained hiking trails. Bicycling is restricted to a select number of PAs in the CDFW network, but none of the CDFW parcels sampled were within them (California Department of Fish and Wildlife, 2016a). For this analysis features managed and maintained by CDFW (e.g. administrative dirt or gravel service and access roads, firebreaks, fire roads) on parcels that could reasonably be used by stakeholders as trails were used included as trails. Note, this analysis does not include informal trails (see Wimpey & Marion 2011). Informal trail networks were observed on parcels, but there was not an accurate way to quantify them within the limited field window. In ArcMap 10.1 SP1 (ESRI, 2012), total trail length within parcels was determined by clipping the trail network layer with the same parcel boundaries described in the methods of Chapter 1 (see page 12) after it was overlaid. Trail length in meters within each parcel was divided by the parcel area in hectares to give the trail density within each parcel.

We were not able to quantify visitor use on all parcels using methods conventional to park managers in the limited field window (Cessford & Muhar, 2003) nor did we have that data for all parcels among the different managing agencies/institutions. Instead we chose to use the amount of trash found on parcels as a proxy for human use and disturbance. In a 10-meter by 10-meter plot extended from the 1-meter by 1-meter biotic disturbance plot, we exhaustively visually surveyed for pieces of trash. Trash counts were averaged across the three sampling locations to determine the mean trash for the parcel.

Covariates

There are several reasons why parcels protected through the ballot process might differ in terms of biotic disturbance levels from those protected by CDFW. They might differ as an indirect result of being ballot parcels, because, for example, these tend to be smaller and closer to urban areas. Differences might also arise from how they are used and managed, independently of these other indirect factors. To evaluate whether any differences arise because of parcels being protected through the ballot per se or because of other direct and indirect factors, we repeated our analyses including various parcel descriptors as covariates (Table 7). Parcel area was calculated from the same parcel boundaries described in the methods of Chapter 1 and used as a covariate because smaller parcels are expected to have proportionally more area exposed to potential disturbance by trails (McKinney, 2005).

Parcel use, and the subsequent disturbance within them, was expected to negatively correlate with distance from larger populations of potential users in urban areas (Cordell, Betz, & Zarnoch, 2013). The 2014 U.S. Census Bureau TIGER/Line urban areas dataset was used to calculate the distance in meters from the boundary of each parcel to the boundary of the nearest of urban area or urban center. This gave the distance from a parcel to the nearest urban footprint (e.g. high population density urban land use).

Table 7. Variation in model covariates.

Variable	Ballot			CDFW		
	1Q	Median	3Q	1Q	Median	3Q
Parcel area (ha)	13.5	63.5	129.7	27.6	73.9	160.9
Distance to urban (m)	0	267.2	1867.4	485.8	5627	10371.1
Years since protection	17	20	29	17	22	31
Mean elevation (m)	155.2	283.3	476.6	20.9	163.4	438.3
Mean latitude (°)	37.3	37.7	38	37	38.2	38.6

Historical land use impacts the abundance of invasive species (Calinger et al., 2015; Dupouey, Dambrine, Laffite, & Moares, 2002; Lundgren, Small, & Dreyer, 2004), but documentation of historical land use for a selection of current protected areas is patchy at best. To partly control for differences in site history, we included time since protection from the year of field sampling, 2015 CE. Year of protection for parcels was determined after consulting agency websites and/or planning documents pertaining to the protected areas encompassing the parcels. For the eight parcels managed by the Midpeninsula Open Space District, the year of protection corresponded to the site at large and not the specific parcel because the latter could not be obtained.

The mean elevation and latitude among the three locations in each parcel were included because of the expected impact on vegetation composition as related to plant life history traits. Elevation was expected to act as an ecological filter on biotic disturbance (Alexander et al., 2011) and exotic species richness has been positively correlated with latitude (Lonsdale, 1999). The decimal degree coordinates and elevation in meters for the southwestern corner of each sampling location was recorded using a Garmin eTrex 20 handheld GPS unit set to the WGS 84 datum and spheroid. The elevation for one sample location in one parcel recorded was determined to be incorrect based on relative elevation to the other two sample locations and excluded prior to the elevation being averaged for the parcel.

Analysis

We used multiple regression with generalized linear models to examine variation in biotic disturbance. Prior to use in any of the models, the variables distance to urban area, parcel area, trail density, and trash were natural log transformed. Any zero values were adjusted by adding a constant prior to transformation. The constant was 1/10 of the smallest non-zero value for each PA type. When considering covariates, we did not consider interaction terms because we did not have an a priori reason to focus on a particular subset of interactions from among the many that are possible. Predictor variables were tested for collinearity and all variance inflation factors (VIF) were within acceptable levels. No VIF exceeded 2 and were well below the conservative threshold of 3.3 (Kock & Lynn, 2012).

We used a generalized linear model with a negative binomial error structure with log-link function. This error structure was chosen because count data was used for the response variable and models with Poisson error structure were over-dispersed. Earlier models using proportion of biotic disturbance with a binomial error structure and logit-link function was also over-dispersed.

A set of models, from among the many possible, was chosen for comparison to highlight the specific questions motivating this study. For the first model, the only predictor used was a binary variable to represent if a parcel was a ballot parcel to see if the effect was strong in and of itself. Second, to reveal whether any differences were due to ballot protection per se or to other factors that tend to be associated with ballot protected parcels, the covariates parcel size, distance to urban, years since protection, elevation, and latitude were incorporated into a model to control for factors presumed to influence biotic disturbance. Lastly, to test whether the key driver of any differences in biotic disturbance levels were related to abiotic disturbances associated with increased recreational use, the predictors trash and trail density were added to the model to represent proxies for human site disturbance and mechanisms for exotic species introduction. Difference in the distributions of trash and trail density between ballot and CDFW parcels were checked with a Mann-Whitney-Wilcoxon test (Mann & Whitney, 1947; Wilcoxon, 1945) prior to the use of the predictors in the model. AIC (Akaike, 1974) was used to judge all three models and determine the most parsimonious explanation of variation in biotic disturbance. We report the explained deviance or pseudo r^2 value ($1 - {}^{\text{residual deviance}}/_{\text{null deviance}}$) as an indicator of the explanatory power of the models (Zuur, Ieno, Walker, Saveliev, & Smith, 2009).

RESULTS

Biotic disturbance

Biotic disturbance varied greatly among protected areas of both types (ballot and CDFW) (Table 8). The three most commonly encountered exotic species were the same regardless of PA type. The grasses *Avena fatua*, *Avena barbata*, and *Bromus diandrus* occurred at 6.2%, 4.2%, and 3.6% of all hits respectively on ballot parcels. On CDFW parcels they accounted for 4.1%, 7.6%, and 9.0% of all hits respectively. No exotic cover was detected only at two CDFW parcels: Quail Hollow Ecological Reserve and Bonny Doon Ecological Reserve. Exotic cover was found at all sampling locations for 18 CDFW parcels, but only 11 ballot parcels.

Table 8. Descriptive statistics of biotic and abiotic disturbance.

	Ballot			CDFW		
Variable	1Q	Median	3Q	1Q	Median	3Q
Biotic disturbance						
# exotic hits (of 300)	20	89	145	60	144	197
Abiotic disturbance						
Trail density (m/ha)	15.6	40.5	65.5	0	0	58.9
Mean pieces of trash	0	1	2.7	0	0.7	1.7

Abiotic disturbance

Indicators of abiotic disturbance levels also varied greatly among both ballot protected parcels and CDFW parcels. The highest trail densities were 597.7 m/ha for ballot and 353.6 m/ha for CDFW. Trails were absent in 5 ballot and 13 CDFW parcels. There was not a statistically detectable difference in the log trail density between parcel types (W = 355, p-value = 0.4108). However the assumption of equal variance for the Mann-Whitney Wilcoxon test was not met ($F = 3.1168$, $df_{num} = 24$, $df_{den} = 24$, $p = 0.007204$) and results should be interpreted carefully.

Most parcels had zero or low amounts of trash found during sampling. The highest amount of trash was found at CDFW's Laguna Wildlife Area outside of Sebastopol, CA. Mean trash was 48 pieces among the 3 parcels, but was influenced by 125 pieces found at one sampling location dominated mainly by glass shards. The highest amount of trash found on a ballot parcel was at Pulgas Ridge Open Space Preserve near San Carlos, CA with a mean of 30.3 pieces of trash. The mean on this parcel was also influenced by one sampling location that contained 87 pieces of trash. The results were not sensitive to either of these high count sampling locations. A comparable number of parcels of each type had no trash detected; 8 for ballot and 7 for CDFW. No statistical difference was detected for log mean trash on parcels (W = 332, p-value = 0.7079).

Modeling biotic disturbance

We first tried to explain variation in biotic disturbance by accounting only for the type of PA (ballot or CDFW). In that model the predictor was non-significant and the variation explained was low (Table 9).

We then added covariates to the model to control for other parcel characteristics. Mean elevation emerged as a significant predictor of biotic disturbance levels. As would be expected given that the two models are nested, this more complicated model also explained more of the variation than model 1. However, a comparison of the AIC values for models 1 and 2 indicates that the simpler model 1 performs better and the additional complexity of the larger model is not warranted.

The last model also included abiotic disturbance alongside the set of predictors already considered in model 2. Both abiotic disturbance variables were included. Elevation remained a significant predictor in the third model with a coefficient similar to that in model 2. Model 3 was able to explain slightly more variation than model 2. However, once again a comparison of AIC values indicated that the increased complexity of this model was not warranted.

Table 9. Summary of model outputs.

Variable	Model 1		Model 2		Model 3	
	Estimate	Pr(>|z|)	Estimate	Pr(>|z|)	Estimate	Pr(>|z|)
Intercept	4.860 ± 0.201	***0.000	3.975 ± 5.544	0.473	6.520 ± 5.613	0.245
Ballot or not	-0.268 ± 0.284	0.345	0.018 ± 0.297	0.953	-0.085 ± 0.294	0.774
Log trail density	-	-	-	-	0.066 ± 0.057	0.249
Log mean trash	-	-	-	-	-0.032 ± 0.078	0.687
Log parcel area	-	-	0.014 ± 0.075	0.858	-0.044 ± 0.080	0.577
Log distance to urban	-	-	0.069 ± 0.040	0.087	0.071 ± 0.042	0.094
Years since protection	-	-	-0.015 ± 0.014	0.290	-0.018 ± 0.017	0.280
Mean elevation	-	-	-0.002 ± 0.001	***0.000	-0.002 ± 0.001	***0.000
Mean latitude	-	-	0.033 ± 0.145	0.819	-0.029 ± 0.147	0.844
AIC		579.05		581.06		583.51
Variation explained		0.01		0.14		0.16

Note: all models run with 50 observations (i.e. n = 50) *equally distributed between both PA types.*

DISCUSSION

This chapter presented a first exploration of whether ballot protected areas are in a comparable ecological condition to protected areas established in other ways. We used cover of exotic plants as an indicator of ecological condition and compared how invaded ballot protected areas were to how invaded were protected areas established by one of the top-down conservation actors featured in Chapter 1. We found that the ballot protected area parcels were in no worse condition than the protected area parcels of the top-down conservation actor CDFW.

Ballot parcels appear not to differ in the level of biotic disturbance when compared to CDFW parcels (Figure 8). We did not find the effect of having been protected through a local ballot initiative to be a significant predictor of biotic disturbance on a parcel in any of the three models tested (Table 9). That is to say we could not detect a difference in biotic disturbance on parcels when only controlling for the identity of the parcel (i.e. ballot or not), when also controlling for direct and indirect factors related to the parcels themselves, and lastly when also controlling for the level of human disturbance that is assumed to affect biotic disturbance. This finding suggests that ballot protected areas are in comparable ecological condition to protected areas established in other ways and could be expected to secure the benefits to the conservation of biodiversity described in Chapter 1.

Although the predictive capacity of the models was low, we were still able to identify significant predictors of variation in biotic disturbance when these were present. In terms of predictive capacity, none of the three models were able to explain more than 16% of the variation in biotic disturbance across protected areas. When elevation was included in model 2 and 3 it was a significant predictor of biotic disturbance levels that applied regardless of how sites were protected (Table 9). The back-transformed coefficient in both models indicates a decrease in biotic disturbance with increasing elevation.

Medvecká et al. (2014) also found a negative effect of elevation on exotic species cover, albeit the significance and direction of the relationship varied based on the habitat type and historical introduction time of the exotic species (i.e. pre- vs post-1500 CE).

There was no detectable difference in abiotic disturbance levels between ballot and CDFW parcels regardless of whether trail density or the amount of trash was used as an indicator of abiotic disturbance. Moreover, neither trail density nor trash were significant predictors of biotic disturbance (Table 9). These results refute the expectation that ballot parcels would be in worse ecological condition because of increased recreational impacts on these sites. The results also run counter to the common refrain that we heard when describing our work to other researchers; that ballot protected area are much more heavily impacted and therefore likely to be of more limited value for conservation. In this study at least, we found no evidence to support this perception.

That the nature of protection of sites was not significant does not mean parcels did not vary in biotic disturbance levels. To the contrary, we found a good deal of variation in the ecological condition of parcels as indicated by cover of exotic species (Table 8). Rather our results show that relative variation in condition is hard to predict using the variables that we considered here. In particular, our Results make clear that just how a parcel was protected on its own does not explain ecological condition. Indeed, the CDFW protected parcels themselves also varied greatly in exotic cover as well as in levels of abiotic disturbance, just as did the ballot sites.

The models presented here are but one of a set of possible combinations based on the assumptions we felt justified in making, however other assumptions would have made sense. For example, predictors in the models were resolved to the parcel level. However for two ballot parcels and six CDFW parcels, they constituted an entire preserve, ecological reserve, or wildlife area (i.e. management unit). Of the other 42 parcels, there was variation in their spatial relation to other unsampled component parcels of their respective management unit. For instance, some sampled parcels were on the edge or interior of the management unit while in some cases all parcels in a management unit would be disjunct and effectively their own entity. While we did control for the effect of parcel size on protected area access and potential for disturbance (McKinney, 2005), we did not control for how the spatial arrangement of parcels within a management unit might also affect access. Our analysis also was limited to “official” recreation trails which are a subset of the amount of total trails on a site. Informal trails, those “that are not planned or constructed and that receive no maintenance" (Hammitt et al., 2015), can range from 0.3-3x the lineal extent of formal trails and have an impact on site condition (Wimpey & Marion, 2011). Extension of this analysis would benefit from the inclusion of informal trails as it would reflect a more accurate condition of recreation trail disturbance (see Marion & Leung (2011) for a discussion on methodology). A final extension of note for this analysis is the response variable. For this analysis we chose to model all exotic species in aggregate. Iacona, Price, & Armsworth (2016) demonstrated that the relationship between predictors and modeled exotic response can be species specific suggesting that our results may not be consistence if modeled for individual exotic species.

We have demonstrated that ballot protected areas, as an example of bottom-up conservation efforts, are in comparable ecological condition to protected areas established by a top-down conservation actor, as exemplified by the California Department of Fish and Wildlife. Evidence of comparable ecological condition suggests that top-down conservation actors can avoid duplicating efforts and exercise their freedom to choose where to protect by considering the benefits provided by the locally motivated land protection.

CONCLUSION

Protected areas secured with funding allocated from local ballots measures, as a form of bottom-up conservation, appeared to offer benefits for conservation, but some initial questions had not previously been addressed. In the first chapter we asked if geographical constraints limited the ability of ballot protected areas to provide benefits to conservation. In the second chapter we examined if the ecological condition of ballot protected areas was determined in part by the way they were created.

Ballot protected areas are sometimes assumed to be of lesser value for conservation than top-down created protected areas. Because their distribution appears geographically clumped, ballot protected areas might be assumed to have a bias in their protection of biodiversity resources. They may also be assumed to be in a more degraded condition because of a general emphasis on their use by the surrounding communities that had part in allocating the funding. We did not find evidence to support either of these assumptions. Overall, our geographic analysis did not reveal a substantial bias in what is protected on these protected areas. Our direct comparison of site condition did not reveal a difference when compared to one type of conventional top-down protected area. Given that ballot protected areas are not biased in what resources they protect and that those resources are not necessarily degraded, it then stands to reason that they should be accounted for when systematically planning future conservation investments. In so much as when considering what is already protected, ballot protected areas should be included in that accounting as well.

Institutional conservation actors (e.g. federal agencies, regional conservation partnerships) already realize the limit of current conservation funding. Alternative revenue streams and strategies are already being considered and explored by large conservation actors. The U.S. Forest Service in partnership with Blue Forest Conservation is currently in the pilot phase of the Forest Resilience Bond, a funding instrument that leverages private capital markets for upfront costs of restoration on national forests to reduce wildlife risk and secure drinking water quality (Madeira & Gartner, 2018). In New England, collaborations among land trusts, municipal, state, and federal agencies, known as regional conservation partnerships are being used to strengthen local conservation actions that are integrated on a regional scale. Currently over 40 regional conservation partnerships involving 350 organizations cover over 60% of New England (Foster et al., 2017).

Because our results do not disqualify ballot protected areas from providing representative protection, they should be considered for similar implementation as one solution to bridging shortfalls in conservation funding and increases in land protection. It may be easier for an institutional conservation actor to plan within their single organization, to only consider the institution's past actions or actions of entities of similar or larger size (e.g. state or federal government/agencies), but to do so would offer a flawed and simplistic reflection of conservation activity. Although accounting for the actions of individual counties, municipalities, and special districts will likely increase the transaction costs of conservation for a larger institutional conservation actor, doing so offers a better chance of reducing redundancies of protection and increasing conservation target achievement through better planning. The higher transaction costs and increased effort required to accomplish getting a more accurate picture of the conservation landscape need not necessarily be thought of as a detraction. It may more accurately be considered front loading the cost during planning to save resources (e.g. time, effort, capital) on the back end and produce a better quality outcome for biodiversity. Albeit with broader assumptions than the analyses in this thesis, this has already been demonstrated by Kroetz et al. (2014) in an illustrative reserve site selection experiment. They demonstrated that by incorporating counties were ballot measures had been passed, an institutional conservation actor's expenditure to protect the same conservation target would be reduced or, alternatively, more targets could be met with the same budget.

How a protected area is created (e.g. through a ballot measure, by a state agency) may not be an important determinant in what benefits to biodiversity conservation are provided by a given protected area, at least when compared to other factors. The "identity" of a protected area may be a proximate factor at best while biophysical factors such as elevation, size, latitude, may be ultimate factors determining what benefits to biodiversity conservation are provided by a given protected area (Hanson, Rhodes, Riginos, & Fuller, 2017; Meiners & Pickett, 2013).

While this thesis is the first parcel-grain analysis evaluating benefits to biodiversity conservation by and condition of protected areas funded by local ballot measures, we realize that it was limited in scope to only one state. Future studies should maintain the parcel-grain scale, but in other systems (i.e. states) to determine if patterns hold. Any loss in benefits to biodiversity conservation may not necessarily devalue the net contribution of ballot protected areas. Future studies would be wise to also calculate the value of other ecosystem services in order to provide a better estimation of the total benefits provided by ballot protected areas. For instance, regulating services (e.g. local climate and air quality, carbon sequestration and storage) or cultural services (e.g. tourism, mental/physical health) when combined with biodiversity could result in a net benefit to both the local communities and wider region in which ballot protected areas occur.

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APPENDIX

Table 10. Description of NLCD 2011 land cover subclasses applicable to continental United States.

Value	Subclass	Class
11	Open Water	Water
12	Perennial Ice/Snow	Water
21	Developed, Open Space	Developed
22	Developed, Low Intensity	Developed
23	Developed, Medium Intensity	Developed
24	Developed, High Intensity	Developed
31	Barren Land (Rock/Sand/Clay)	Barren
41	Deciduous Forest	Forest
42	Evergreen Forest	Forest
43	Mixed Forest	Forest
52	Shrub/Scrub	Shrubland
71	Grassland/Herbaceous	Herbaceous
81	Pasture/Hay	Planted/Cultivated
82	Cultivated Crops	Planted/Cultivated
90	Wood Wetlands	Wetlands
95	Emergent Herbaceous Wetlands	Wetlands

Table 11. Description of CDFW CWHR habitat types identified by numerical habitat code.

Habitat code	Habitat type	Category
0	Subalpine Conifer	Tree dominated
1	Red Fir	Tree dominated
2	Lodgepole Pine	Tree dominated
3	Sierran Mixed Conifer	Tree dominated
4	White Fir	Tree dominated
5	Klamath Mixed Conifer	Tree dominated
6	Douglas Fir	Tree dominated
7	Jeffrey Pine	Tree dominated
8	Ponderosa Pine	Tree dominated
9	Eastside Pine	Tree dominated
10	Redwood	Tree dominated
11	Pinyon-Juniper	Tree dominated
12	Juniper	Tree dominated
13	Aspen	Tree dominated
14	Closed-Cone Pine-Cypress	Tree dominated
15	Montane Hardwood-Conifer	Tree dominated
16	Montane Hardwood	Tree dominated
17	Blue Oak Woodland	Tree dominated
18	Valley Oak Woodland	Tree dominated
19	Coastal Oak Woodland	Tree dominated
20	Blue Oak-Foothill Pine	Tree dominated
21	Eucalyptus	Tree dominated
22	Montane Riparian	Tree dominated
23	Valley Foothill Riparian	Tree dominated
24	Desert Riparian	Tree dominated
25	Palm Oasis	Tree dominated
26	Joshua Tree	Tree dominated
27	Alpine Dwarf-Shrub	Shrub dominated
28	Low Sage	Shrub dominated
29	Bitterbrush	Shrub dominated
30	Sagebrush	Shrub dominated
31	Montane Chaparral	Shrub dominated
32	Mixed Chaparral	Shrub dominated

Table 11 (continued).

Habitat code	Habitat type	Category
33	Chamise-Redshank Chaparral	Shrub dominated
34	Coastal Scrub	Shrub dominated
35	Desert Succulent Shrub	Shrub dominated
36	Desert Wash	Shrub dominated
37	Desert Scrub	Shrub dominated
38	Alkali Desert Scrub	Shrub dominated
39	Annual Grassland	Herbaceous dominated
40	Perennial Grassland	Herbaceous dominated
41	Wet Meadow	Herbaceous dominated
42	Fresh Emergent Wetland	Herbaceous dominated
43	Saline Emergent Wetland	Herbaceous dominated
44	Pasture	Herbaceous dominated
45	Riverine	Aquatic
46	Lacustrine	Aquatic
47	Estuarine	Aquatic
50	Dryland Grain Crops	Developed
51	Irrigated Grain Crops	Developed
52	Irrigated Hayfield	Developed
53	Irrigated Row and Field Crops	Developed
54	Rice	Developed
56	Deciduous Orchard	Developed
57	Evergreen Orchard	Developed
58	Vineyard	Developed
59	Urban	Developed
60	Barren	Non-vegetated

Table 12. Description of CDFW CWHR species identified by alphanumeric species code.

Class	Species ID	Common name	Scientific name
Amphibia	**a001**	**California Tiger Salamander**	***Ambystoma californiense***
Amphibia	a002	Northwestern Salamander	*Ambystoma gracile*
Amphibia	a003	Long-toed Salamander	*Ambystoma macrodactylum*
Amphibia	a004	California Giant Salamander	*Dicamptodon ensatus*
Amphibia	**a005**	**Southern Torrent Salamander**	***Rhyacotriton variegatus***
Amphibia	a006	Rough-skinned Newt	*Taricha granulosa*
Amphibia	**a007**	**California Newt**	***Taricha torosa***
Amphibia	a008	Red-bellied Newt	*Taricha rivularis*
Amphibia	a009	Dunn's Salamander	*Plethodon dunni*
Amphibia	**a010**	**Del Norte Salamander**	***Plethodon elongatus***
Amphibia	a011	Siskiyou Mountains Salamander	*Plethodon stormi*
Amphibia	**a012**	**Common Ensatina**	***Ensatina eschscholtzii***
Amphibia	a013	Southern California Slender Salamander	*Batrachoseps major*
Amphibia	a014	California Slender Salamander	*Batrachoseps attenuatus*
Amphibia	a015	Black-bellied Slender Salamander	*Batrachoseps nigriventris*
Amphibia	a016	Channel Islands Slender Salamander	*Batrachoseps pacificus*
Amphibia	a017	Kern Canyon Slender Salamander	*Batrachoseps simatus*
Amphibia	a018	Tehachapi Slender Salamander	*Batrachoseps stebbinsi*
Amphibia	**a019**	**Inyo Mountains Salamander**	***Batrachoseps campi***
Amphibia	a020	Speckled Black Salamander	*Aneides flavipunctatus*
Amphibia	a021	Clouded Salamander	*Aneides ferreus*
Amphibia	a022	Arboreal Salamander	*Aneides lugubris*
Amphibia	**a023**	**Mount Lyell Salamander**	***Hydromantes platycephalus***
Amphibia	a024	Shasta Salamander	*Hydromantes shastae*
Amphibia	a025	Limestone Salamander	*Hydromantes brunus*
Amphibia	**a026**	**Coastal Tailed Frog**	***Ascaphus truei***
Amphibia	**a027**	**Couch's Spadefoot**	***Scaphiopus couchii***
Amphibia	**a028**	**Western Spadefoot**	***Spea hammondii***
Amphibia	a029	Great Basin Spadefoot	*Spea intermontana*
Amphibia	**a030**	**Sonoran Desert Toad**	***Incilius alvarius***
Amphibia	a031	Black Toad	*Anaxyrus exsul*
Amphibia	a032	Western Toad	*Anaxyrus boreas*
Amphibia	**a033**	**Yosemite Toad**	***Anaxyrus canorus***
Amphibia	a034	Woodhouse's Toad	*Anaxyrus woodhousii*

**Bold row indicates a Species of Special Concern in California.*

Table 12 (continued).

Class	Species ID	Common name	Scientific name
Amphibia	a035	Arroyo Toad	*Anaxyrus californicus*
Amphibia	a036	Red-spotted Toad	*Anaxyrus punctatus*
Amphibia	a037	Great Plains Toad	*Anaxyrus cognatus*
Amphibia	a038	California Treefrog	*Pseudacris cadaverina*
Amphibia	a039	Pacific Treefrog	*Pseudacris regilla*
Amphibia	**a040**	**Northern Red-legged Frog**	***Rana aurora***
Amphibia	**a041**	**Oregon Spotted Frog**	***Rana pretiosa***
Amphibia	**a042**	**Cascades Frog**	***Rana cascadae***
Amphibia	**a043**	**Foothill Yellow-legged Frog**	***Rana boylii***
Amphibia	**a044**	**Sierra Madre Yellow-legged Frog**	***Rana muscosa***
Amphibia	**a045**	**Northern Leopard Frog**	***Lithobates pipiens***
Amphibia	a046	American Bullfrog	*Lithobates catesbeianus*
Amphibia	a047	Western Tiger Salamander	*Ambystoma mavortium*
Amphibia	a048	Pacific Giant Salamander	*Dicamptodon tenebrosus*
Amphibia	**a049**	**Relictual Slender Salamander**	***Batrachoseps relictus***
Amphibia	a050	Rio Grande Leopard Frog	*Lithobates berlandieri*
Amphibia	a053	San Gabriel Slender Salamander	*Batrachoseps gabrieli*
Amphibia	a056	Gabilan Mountains Slender Salamander	*Batrachoseps gavilanensis*
Amphibia	a057	Santa Lucia Slender Salamander	*Batrachoseps luciae*
Amphibia	a058	Lesser Slender Salamander	*Batrachoseps minor*
Amphibia	a059	San Simeon Slender Salamander	*Batrachoseps incognitus*
Amphibia	a060	Kings River Slender Salamander	*Batrachoseps regius*
Amphibia	a061	Sequoia Slender Salamander	*Batrachoseps kawia*
Amphibia	a062	Hell Hollow Slender Salamander	*Batrachoseps diabolicus*
Amphibia	a063	Kern Plateau Salamander	*Batrachoseps robustus*
Amphibia	**a066**	**Large-blotched Ensatina**	***Ensatina klauberi***
Amphibia	a067	Scott Bar Salamander	*Plethodon asupak*
Amphibia	a068	Wandering Salamander	*Aneides vagrans*
Amphibia	**a070**	**Sierra Nevada Yellow-legged Frog**	***Rana sierrae***
Amphibia	**a071**	**California Red-legged Frog**	***Rana draytonii***
Amphibia	a072	Santa Cruz Black Salamander	*Aneides niger*
Amphibia	a073	Fairview Slender Salamander	*Batrachoseps bramei*
Amphibia	a074	Greenhorn Mountains Slender Salamander	*Batrachoseps altasierrae*
Amphibia	a075	Sierra Newt	*Taricha sierrae*
Amphibia	a076	Baja California Treefrog	*Pseudacris hypochondriaca*

**Bold row indicates a Species of Special Concern in California.*

Table 12 (continued).

Class	Species ID	Common name	Scientific name
Amphibia	a077	Sierran Treefrog	*Pseudacris sierra*
Amphibia	a078	Columbia Spotted Frog	*Rana luteiventris*
Aves	b001	Red-throated Loon	*Gavia stellata*
Aves	b002	Pacific Loon	*Gavia pacifica*
Aves	**b003**	**Common Loon**	***Gavia immer***
Aves	b006	Pied-billed Grebe	*Podilymbus podiceps*
Aves	b007	Horned Grebe	*Podiceps auritus*
Aves	b008	Red-necked Grebe	*Podiceps grisegena*
Aves	b009	Eared Grebe	*Podiceps nigricollis*
Aves	b010	Western Grebe	*Aechmophorus occidentalis*
Aves	**b042**	**American White Pelican**	***Pelecanus erythrorhynchos***
Aves	b043	Brown Pelican	*Pelecanus occidentalis*
Aves	b044	Double-crested Cormorant	*Phalacrocorax auritus*
Aves	b046	Brandt's Cormorant	*Phalacrocorax penicillatus*
Aves	b047	Pelagic Cormorant	*Phalacrocorax pelagicus*
Aves	b049	American Bittern	*Botaurus lentiginosus*
Aves	**b050**	**Least Bittern**	***Ixobrychus exilis***
Aves	b051	Great Blue Heron	*Ardea herodias*
Aves	b052	Great Egret	*Ardea alba*
Aves	b053	Snowy Egret	*Egretta thula*
Aves	b057	Cattle Egret	*Bubulcus ibis*
Aves	b058	Green Heron	*Butorides virescens*
Aves	b059	Black-crowned Night Heron	*Nycticorax nycticorax*
Aves	b062	White-faced Ibis	*Plegadis chihi*
Aves	**b065**	**Fulvous Whistling-Duck**	***Dendrocygna bicolor***
Aves	b067	Tundra Swan	*Cygnus columbianus*
Aves	**b070**	**Greater White-fronted Goose**	***Anser albifrons***
Aves	b071	Snow Goose	*Chen caerulescens*
Aves	b072	Ross's Goose	*Chen rossii*
Aves	**b074**	**Brant**	***Branta bernicla***
Aves	b075	Canada Goose	*Branta canadensis*
Aves	b076	Wood Duck	*Aix sponsa*
Aves	b077	Green-winged Teal	*Anas crecca*
Aves	b079	Mallard	*Anas platyrhynchos*
Aves	b080	Northern Pintail	*Anas acuta*

**Bold row indicates a Species of Special Concern in California.*

Table 12 (continued).

Class	Species ID	Common name	Scientific name
Aves	b082	Blue-winged Teal	*Anas discors*
Aves	b083	Cinnamon Teal	*Anas cyanoptera*
Aves	b084	Northern Shoveler	*Anas clypeata*
Aves	b085	Gadwall	*Anas strepera*
Aves	b086	Eurasian Wigeon	*Anas penelope*
Aves	b087	American Wigeon	*Anas americana*
Aves	b089	Canvasback	*Aythya valisineria*
Aves	**b090**	**Redhead**	***Aythya americana***
Aves	b091	Ring-necked Duck	*Aythya collaris*
Aves	b093	Greater Scaup	*Aythya marila*
Aves	b094	Lesser Scaup	*Aythya affinis*
Aves	**b096**	**Harlequin Duck**	***Histrionicus histrionicus***
Aves	b097	Long-tailed Duck	*Clangula hyemalis*
Aves	b098	Black Scoter	*Melanitta americana (nigra)*
Aves	b099	Surf Scoter	*Melanitta perspicillata*
Aves	b100	White-winged Scoter	*Melanitta fusca*
Aves	b101	Common Goldeneye	*Bucephala clangula*
Aves	**b102**	**Barrow's Goldeneye**	***Bucephala islandica***
Aves	b103	Bufflehead	*Bucephala albeola*
Aves	b104	Hooded Merganser	*Lophodytes cucullatus*
Aves	b105	Common Merganser	*Mergus merganser*
Aves	b106	Red-breasted Merganser	*Mergus serrator*
Aves	b107	Ruddy Duck	*Oxyura jamaicensis*
Aves	b108	Turkey Vulture	*Cathartes aura*
Aves	b109	California Condor	*Gymnogyps californianus*
Aves	b110	Osprey	*Pandion haliaetus*
Aves	b111	White-tailed Kite	*Elanus leucurus*
Aves	b113	Bald Eagle	*Haliaeetus leucocephalus*
Aves	**b114**	**Northern Harrier**	***Circus cyaneus***
Aves	b115	Sharp-shinned Hawk	*Accipiter striatus*
Aves	b116	Cooper's Hawk	*Accipiter cooperii*
Aves	**b117**	**Northern Goshawk**	***Accipiter gentilis***
Aves	b119	Red-shouldered Hawk	*Buteo lineatus*
Aves	b121	Swainson's Hawk	*Buteo swainsoni*
Aves	b123	Red-tailed Hawk	*Buteo jamaicensis*

**Bold row indicates a Species of Special Concern in California.*

Table 12 (continued).

Class	Species ID	Common name	Scientific name
Aves	b124	Ferruginous Hawk	*Buteo regalis*
Aves	b125	Rough-legged Hawk	*Buteo lagopus*
Aves	b126	Golden Eagle	*Aquila chrysaetos*
Aves	b127	American Kestrel	*Falco sparverius*
Aves	b128	Merlin	*Falco columbarius*
Aves	b129	Peregrine Falcon	*Falco peregrinus*
Aves	b131	Prairie Falcon	*Falco mexicanus*
Aves	b132	Chukar	*Alectoris chukar*
Aves	b133	Ring-necked Pheasant	*Phasianus colchicus*
Aves	**b134**	**Sooty Grouse**	***Dendragapus fuliginosus***
Aves	b135	White-tailed Ptarmigan	*Lagopus leucura*
Aves	b136	Ruffed Grouse	*Bonasa umbellus*
Aves	**b137**	**Greater Sage-Grouse**	***Centrocercus urophasianus***
Aves	b138	Wild Turkey	*Meleagris gallopavo*
Aves	b139	Gambel's Quail	*Callipepla gambelii*
Aves	**b140**	**California Quail**	***Callipepla californica***
Aves	b141	Mountain Quail	*Oreortyx pictus*
Aves	b143	Black Rail	*Laterallus jamaicensis*
Aves	b144	Clapper Rail	*Rallus longirostris*
Aves	b145	Virginia Rail	*Rallus limicola*
Aves	b146	Sora	*Porzana carolina*
Aves	b148	Common Gallinule	*Gallinula galeata*
Aves	b149	American Coot	*Fulica americana*
Aves	**b150**	**Sandhill Crane**	***Grus canadensis***
Aves	b151	Black-bellied Plover	*Pluvialis squatarola*
Aves	**b154**	**Snowy Plover**	***Charadrius nivosus***
Aves	b156	Semipalmated Plover	*Charadrius semipalmatus*
Aves	b158	Killdeer	*Charadrius vociferus*
Aves	**b159**	**Mountain Plover**	***Charadrius montanus***
Aves	b162	Black Oystercatcher	*Haematopus bachmani*
Aves	b163	Black-necked Stilt	*Himantopus mexicanus*
Aves	b164	American Avocet	*Recurvirostra americana*
Aves	b165	Greater Yellowlegs	*Tringa melanoleuca*
Aves	b166	Lesser Yellowlegs	*Tringa flavipes*
Aves	b168	Willet	*Tringa semipalmata*

**Bold row indicates a Species of Special Concern in California.*

Table 12 (continued).

Class	Species ID	Common name	Scientific name
Aves	b169	Wandering Tattler	*Tringa incana*
Aves	b170	Spotted Sandpiper	*Actitis macularius*
Aves	b172	Whimbrel	*Numenius phaeopus*
Aves	b173	Long-billed Curlew	*Numenius americanus*
Aves	b176	Marbled Godwit	*Limosa fedoa*
Aves	b177	Ruddy Turnstone	*Arenaria interpres*
Aves	b178	Black Turnstone	*Arenaria melanocephala*
Aves	b179	Surfbird	*Calidris virgata*
Aves	b180	Red Knot	*Calidris canutus*
Aves	b181	Sanderling	*Calidris alba*
Aves	b183	Western Sandpiper	*Calidris mauri*
Aves	b185	Least Sandpiper	*Calidris minutilla*
Aves	b190	Rock Sandpiper	*Calidris ptilocnemis*
Aves	b191	Dunlin	*Calidris alpina*
Aves	b193	Stilt Sandpiper	*Calidris himantopus*
Aves	b196	Short-billed Dowitcher	*Limnodromus griseus*
Aves	b197	Long-billed Dowitcher	*Limnodromus scolopaceus*
Aves	b199	Wilson's Snipe	*Gallinago delicata*
Aves	b200	Wilson's Phalarope	*Phalaropus tricolor*
Aves	b211	Bonaparte's Gull	*Chroicocephalus philadelphia*
Aves	b212	Heermann's Gull	*Larus heermanni*
Aves	b213	Mew Gull	*Larus canus*
Aves	b214	Ring-billed Gull	*Larus delawarensis*
Aves	b215	California Gull	*Larus californicus*
Aves	b216	Herring Gull	*Larus argentatus*
Aves	b217	Thayer's Gull	*Larus thayeri*
Aves	b219	Yellow-footed Gull	*Larus livens*
Aves	b220	Western Gull	*Larus occidentalis*
Aves	b221	Glaucous-winged Gull	*Larus glaucescens*
Aves	**b226**	**Gull-billed Tern**	***Gelochelidon nilotica***
Aves	b227	Caspian Tern	*Hydroprogne caspia*
Aves	b228	Royal Tern	*Thalasseus maximus*
Aves	b229	Elegant Tern	*Thalasseus elegans*
Aves	b231	Common Tern	*Sterna hirundo*
Aves	b233	Forster's Tern	*Sterna forsteri*

**Bold row indicates a Species of Special Concern in California.*

Table 12 (continued).

Class	Species ID	Common name	Scientific name
Aves	b234	Least Tern	*Sternula antillarum*
Aves	**b235**	**Black Tern**	***Chlidonias niger***
Aves	**b236**	**Black Skimmer**	***Rynchops niger***
Aves	b237	Common Murre	*Uria aalge*
Aves	b239	Pigeon Guillemot	*Cepphus columba*
Aves	b240	Marbled Murrelet	*Brachyramphus marmoratus*
Aves	b241	Scripps's Murrelet	*Synthliboramphus scrippsi*
Aves	b243	Ancient Murrelet	*Synthliboramphus antiquus*
Aves	**b244**	**Cassin's Auklet**	***Ptychoramphus aleuticus***
Aves	b247	Rhinoceros Auklet	*Cerorhinca monocerata*
Aves	**b248**	**Tufted Puffin**	***Fratercula cirrhata***
Aves	b250	Rock Pigeon	*Columba livia*
Aves	b251	Band-tailed Pigeon	*Patagioenas fasciata*
Aves	b252	Ringed Turtle-Dove	*Streptopelia risoria*
Aves	b253	Spotted Dove	*Streptopelia chinensis*
Aves	b254	White-winged Dove	*Zenaida asiatica*
Aves	b255	Mourning Dove	*Zenaida macroura*
Aves	b256	Inca Dove	*Columbina inca*
Aves	b257	Common Ground-Dove	*Columbina passerina*
Aves	b259	Yellow-billed Cuckoo	*Coccyzus americanus*
Aves	b260	Greater Roadrunner	*Geococcyx californianus*
Aves	b262	Barn Owl	*Tyto alba*
Aves	b263	Flammulated Owl	*Psiloscops flammeolus*
Aves	b264	Western Screech Owl	*Megascops kennicottii*
Aves	b265	Great Horned Owl	*Bubo virginianus*
Aves	b267	Northern Pygmy Owl	*Glaucidium gnoma*
Aves	b268	Elf Owl	*Micrathene whitneyi*
Aves	**b269**	**Burrowing Owl**	***Athene cunicularia***
Aves	**b270**	**Spotted Owl**	***Strix occidentalis***
Aves	b271	Great Gray Owl	*Strix nebulosa*
Aves	**b272**	**Long-eared Owl**	***Asio otus***
Aves	**b273**	**Short-eared Owl**	***Asio flammeus***
Aves	b274	Northern Saw-whet Owl	*Aegolius acadicus*
Aves	b275	Lesser Nighthawk	*Chordeiles acutipennis*
Aves	b276	Common Nighthawk	*Chordeiles minor*

**Bold row indicates a Species of Special Concern in California.*

Table 12 (continued).

Class	Species ID	Common name	Scientific name
Aves	b277	Common Poorwill	*Phalaenoptilus nuttallii*
Aves	b278	Eastern Whip-poor-will	*Antrostomus vociferus*
Aves	**b279**	**Black Swift**	***Cypseloides niger***
Aves	**b281**	**Vaux's Swift**	***Chaetura vauxi***
Aves	b282	White-throated Swift	*Aeronautes saxatalis*
Aves	b286	Black-chinned Hummingbird	*Archilochus alexandri*
Aves	b287	Anna's Hummingbird	*Calypte anna*
Aves	b288	Costa's Hummingbird	*Calypte costae*
Aves	b289	Calliope Hummingbird	*Selasphorus calliope*
Aves	b290	Broad-tailed Hummingbird	*Selasphorus platycercus*
Aves	b291	Rufous Hummingbird	*Selasphorus rufus*
Aves	b292	Allen's Hummingbird	*Selasphorus sasin*
Aves	b293	Belted Kingfisher	*Megaceryle alcyon*
Aves	b294	Lewis's Woodpecker	*Melanerpes lewis*
Aves	b296	Acorn Woodpecker	*Melanerpes formicivorus*
Aves	b297	Gila Woodpecker	*Melanerpes uropygialis*
Aves	b298	Red-naped Sapsucker	*Sphyrapicus nuchalis*
Aves	b299	Red-breasted Sapsucker	*Sphyrapicus ruber*
Aves	b300	Williamson's Sapsucker	*Sphyrapicus thyroideus*
Aves	b301	Ladder-backed Woodpecker	*Picoides scalaris*
Aves	b302	Nuttall's Woodpecker	*Picoides nuttallii*
Aves	b303	Downy Woodpecker	*Picoides pubescens*
Aves	b304	Hairy Woodpecker	*Picoides villosus*
Aves	b305	White-headed Woodpecker	*Picoides albolarvatus*
Aves	b306	Black-backed Woodpecker	*Picoides arcticus*
Aves	b307	Northern Flicker	*Colaptes auratus*
Aves	b308	Pileated Woodpecker	*Dryocopus pileatus*
Aves	**b309**	**Olive-sided Flycatcher**	***Contopus cooperi***
Aves	b311	Western Wood-Pewee	*Contopus sordidulus*
Aves	b315	Willow Flycatcher	*Empidonax traillii*
Aves	b317	Hammond's Flycatcher	*Empidonax hammondii*
Aves	b318	Dusky Flycatcher	*Empidonax oberholseri*
Aves	b319	Gray Flycatcher	*Empidonax wrightii*
Aves	b320	Pacific-slope Flycatcher	*Empidonax difficilis*
Aves	b321	Black Phoebe	*Sayornis nigricans*

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Table 12 (continued).

Class	Species ID	Common name	Scientific name
Aves	b323	Say's Phoebe	*Sayornis saya*
Aves	**b324**	**Vermilion Flycatcher**	***Pyrocephalus rubinus***
Aves	b326	Ash-throated Flycatcher	*Myiarchus cinerascens*
Aves	b328	Brown-crested Flycatcher	*Myiarchus tyrannulus*
Aves	b331	Cassin's Kingbird	*Tyrannus vociferans*
Aves	b333	Western Kingbird	*Tyrannus verticalis*
Aves	b334	Eastern Kingbird	*Tyrannus tyrannus*
Aves	b337	Horned Lark	*Eremophila alpestris*
Aves	**b338**	**Purple Martin**	***Progne subis***
Aves	b339	Tree Swallow	*Tachycineta bicolor*
Aves	b340	Violet-green Swallow	*Tachycineta thalassina*
Aves	b341	Northern Rough-winged Swallow	*Stelgidopteryx serripennis*
Aves	b342	Bank Swallow	*Riparia riparia*
Aves	b343	Cliff Swallow	*Petrochelidon pyrrhonota*
Aves	b344	Barn Swallow	*Hirundo rustica*
Aves	b345	Gray Jay	*Perisoreus canadensis*
Aves	b346	Steller's Jay	*Cyanocitta stelleri*
Aves	b348	Western Scrub-Jay	*Aphelocoma californica*
Aves	b349	Pinyon Jay	*Gymnorhinus cyanocephalus*
Aves	b350	Clark's Nutcracker	*Nucifraga columbiana*
Aves	b351	Black-billed Magpie	*Pica hudsonia*
Aves	b352	Yellow-billed Magpie	*Pica nuttalli*
Aves	b353	American Crow	*Corvus brachyrhynchos*
Aves	b354	Common Raven	*Corvus corax*
Aves	b355	Black-capped Chickadee	*Poecile atricapillus*
Aves	b356	Mountain Chickadee	*Poecile gambeli*
Aves	b357	Chestnut-backed Chickadee	*Poecile rufescens*
Aves	b358	Oak Titmouse	*Baeolophus inornatus*
Aves	b359	Verdin	*Auriparus flaviceps*
Aves	b360	Bushtit	*Psaltriparus minimus*
Aves	b361	Red-breasted Nuthatch	*Sitta canadensis*
Aves	b362	White-breasted Nuthatch	*Sitta carolinensis*
Aves	b363	Pygmy Nuthatch	*Sitta pygmaea*
Aves	b364	Brown Creeper	*Certhia americana*
Aves	**b365**	**Cactus Wren**	***Campylorhynchus brunneicapillus***

**Bold row indicates a Species of Special Concern in California.*

Table 12 (continued).

Class	Species ID	Common name	Scientific name
Aves	b366	Rock Wren	*Salpinctes obsoletus*
Aves	b367	Canyon Wren	*Catherpes mexicanus*
Aves	**b368**	**Bewick's Wren**	***Thryomanes bewickii***
Aves	b369	House Wren	*Troglodytes aedon*
Aves	b370	Pacific Wren	*Troglodytes pacificus*
Aves	**b372**	**Marsh Wren**	***Cistothorus palustris***
Aves	b373	American Dipper	*Cinclus mexicanus*
Aves	b375	Golden-crowned Kinglet	*Regulus satrapa*
Aves	b376	Ruby-crowned Kinglet	*Regulus calendula*
Aves	b377	Blue-gray Gnatcatcher	*Polioptila caerulea*
Aves	b378	Black-tailed Gnatcatcher	*Polioptila melanura*
Aves	b380	Western Bluebird	*Sialia mexicana*
Aves	b381	Mountain Bluebird	*Sialia currucoides*
Aves	b382	Townsend's Solitaire	*Myadestes townsendi*
Aves	b385	Swainson's Thrush	*Catharus ustulatus*
Aves	b386	Hermit Thrush	*Catharus guttatus*
Aves	b389	American Robin	*Turdus migratorius*
Aves	b390	Varied Thrush	*Ixoreus naevius*
Aves	b391	Wrentit	*Chamaea fasciata*
Aves	b393	Northern Mockingbird	*Mimus polyglottos*
Aves	b394	Sage Thrasher	*Oreoscoptes montanus*
Aves	**b396**	**Bendire's Thrasher**	***Toxostoma bendirei***
Aves	b398	California Thrasher	*Toxostoma redivivum*
Aves	**b399**	**Crissal Thrasher**	***Toxostoma crissale***
Aves	**b400**	**Le Conte's Thrasher**	***Toxostoma lecontei***
Aves	b404	American Pipit	*Anthus rubrescens*
Aves	b407	Cedar Waxwing	*Bombycilla cedrorum*
Aves	b408	Phainopepla	*Phainopepla nitens*
Aves	b409	Northern Shrike	*Lanius excubitor*
Aves	**b410**	**Loggerhead Shrike**	***Lanius ludovicianus***
Aves	b411	European Starling	*Sturnus vulgaris*
Aves	b413	Bell's Vireo	*Vireo bellii*
Aves	**b414**	**Gray Vireo**	***Vireo vicinior***
Aves	b415	Cassin's Vireo	*Vireo cassinii*
Aves	**b417**	**Hutton's Vireo**	***Vireo huttoni***

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Table 12 (continued).

Class	Species ID	Common name	Scientific name
Aves	b418	Warbling Vireo	*Vireo gilvus*
Aves	b425	Orange-crowned Warbler	*Oreothlypis celata*
Aves	b426	Nashville Warbler	*Oreothlypis ruficapilla*
Aves	b427	Virginia's Warbler	*Oreothlypis virginiae*
Aves	**b428**	**Lucy's Warbler**	***Oreothlypis luciae***
Aves	**b430**	**Yellow Warbler**	***Setophaga petechia***
Aves	b435	Yellow-rumped Warbler	*Setophaga coronata*
Aves	b436	Black-throated Gray Warbler	*Setophaga nigrescens*
Aves	b437	Townsend's Warbler	*Setophaga townsendi*
Aves	b438	Hermit Warbler	*Setophaga occidentalis*
Aves	b460	Macgillivray's Warbler	*Geothlypis tolmiei*
Aves	**b461**	**Common Yellowthroat**	***Geothlypis trichas***
Aves	b463	Wilson's Warbler	*Cardellina pusilla*
Aves	**b467**	**Yellow-breasted Chat**	***Icteria virens***
Aves	**b469**	**Summer Tanager**	***Piranga rubra***
Aves	b471	Western Tanager	*Piranga ludoviciana*
Aves	b475	Black-headed Grosbeak	*Pheucticus melanocephalus*
Aves	b476	Blue Grosbeak	*Passerina caerulea*
Aves	b477	Lazuli Bunting	*Passerina amoena*
Aves	b482	Green-tailed Towhee	*Pipilo chlorurus*
Aves	**b483**	**Spotted Towhee**	***Pipilo maculatus***
Aves	b484	California Towhee	*Pipilo crissalis*
Aves	b485	Abert's Towhee	*Melozone aberti*
Aves	**b487**	**Rufous-crowned Sparrow**	***Aimophila ruficeps***
Aves	b489	Chipping Sparrow	*Spizella passerina*
Aves	b491	Brewer's Sparrow	*Spizella breweri*
Aves	b493	Black-chinned Sparrow	*Spizella atrogularis*
Aves	**b494**	**Vesper Sparrow**	***Pooecetes gramineus***
Aves	b495	Lark Sparrow	*Chondestes grammacus*
Aves	b496	Black-throated Sparrow	*Amphispiza bilineata*
Aves	**b497**	**Sage (Bell's) Sparrow**	***Artemisiospiza belli***
Aves	**b499**	**Savannah Sparrow**	***Passerculus sandwichensis***
Aves	**b501**	**Grasshopper Sparrow**	***Ammodramus savannarum***
Aves	b504	Fox Sparrow	*Passerella iliaca*
Aves	**b505**	**Song Sparrow**	***Melospiza melodia***

**Bold row indicates a Species of Special Concern in California.*

Table 12 (continued).

Class	Species ID	Common name	Scientific name
Aves	b506	Lincoln's Sparrow	*Melospiza lincolnii*
Aves	b509	Golden-crowned Sparrow	*Zonotrichia atricapilla*
Aves	b510	White-crowned Sparrow	*Zonotrichia leucophrys*
Aves	b512	Dark-eyed Junco	*Junco hyemalis*
Aves	b514	Lapland Longspur	*Calcarius lapponicus*
Aves	**b519**	**Red-winged Blackbird**	***Agelaius phoeniceus***
Aves	**b520**	**Tricolored Blackbird**	***Agelaius tricolor***
Aves	b521	Western Meadowlark	*Sturnella neglecta*
Aves	**b522**	**Yellow-headed Blackbird**	***Xanthocephalus xanthocephalus***
Aves	b524	Brewer's Blackbird	*Euphagus cyanocephalus*
Aves	b525	Great-tailed Grackle	*Quiscalus mexicanus*
Aves	b527	Bronzed Cowbird	*Molothrus aeneus*
Aves	b528	Brown-headed Cowbird	*Molothrus ater*
Aves	b530	Hooded Oriole	*Icterus cucullatus*
Aves	b532	Bullock's Oriole	*Icterus bullockii*
Aves	b533	Scott's Oriole	*Icterus parisorum*
Aves	b534	Gray-crowned Rosy-Finch	*Leucosticte tephrocotis*
Aves	b535	Pine Grosbeak	*Pinicola enucleator*
Aves	b536	Purple Finch	*Haemorhous purpureus*
Aves	b537	Cassin's Finch	*Haemorhous cassinii*
Aves	b538	House Finch	*Haemorhous mexicanus*
Aves	b539	Red Crossbill	*Loxia curvirostra*
Aves	b542	Pine Siskin	*Spinus pinus*
Aves	b543	Lesser Goldfinch	*Spinus psaltria*
Aves	b544	Lawrence's Goldfinch	*Spinus lawrencei*
Aves	b545	American Goldfinch	*Spinus tristis*
Aves	b546	Evening Grosbeak	*Coccothraustes vespertinus*
Aves	b547	House Sparrow	*Passer domesticus*
Aves	b548	Clark's Grebe	*Aechmophorus clarkii*
Aves	b549	Gilded Flicker	*Colaptes chrysoides*
Aves	b550	Cordilleran Flycatcher	*Empidonax occidentalis*
Aves	b551	Island Scrub-Jay	*Aphelocoma insularis*
Aves	b552	Juniper Titmouse	*Baeolophus ridgewayi*
Aves	**b553**	**California Gnatcatcher**	***Polioptila californica***
Aves	b554	Plumbeous Vireo	*Vireo plumbeus*

**Bold row indicates a Species of Special Concern in California.*

Table 12 (continued).

Class	Species ID	Common name	Scientific name
Aves	**b579**	**Fork-tailed Storm-Petrel**	***Oceanodroma furcata***
Aves	b580	Leach's Storm-Petrel	*Oceanodroma leucorhoa*
Aves	**b581**	**Ashy Storm-Petrel**	***Oceanodroma homochroa***
Aves	**b584**	**Black Storm-Petrel**	***Oceanodroma melania***
Aves	**b603**	**Wood Stork**	***Mycteria americana***
Aves	b620	Harris's Hawk	*Parabuteo unicinctus*
Aves	b629	Pacific Golden-Plover	*Pluvialis fulva*
Aves	b634	American Oystercatcher	*Haematopus palliatus*
Aves	b648	Baird's Sandpiper	*Calidris bairdii*
Aves	b649	Pectoral Sandpiper	*Calidris melanotos*
Aves	b655	Red-necked Phalarope	*Phalaropus lobatus*
Aves	b656	Red Phalarope	*Phalaropus fulicarius*
Aves	b699	Barred Owl	*Strix varia*
Aves	b702	Chimney Swift	*Chaetura pelagica*
Aves	b773	American Redstart	*Setophaga ruticilla*
Aves	b798	White-throated Sparrow	*Zonotrichia albicollis*
Aves	b799	Harris's Sparrow	*Zonotrichia querula*
Aves	b806	Northern Cardinal	*Cardinalis cardinalis*
Aves	b809	Indigo Bunting	*Passerina cyanea*
Aves	b864	Cackling Goose	*Branta hutchinsii*
Mammalia	m001	Virginia Opossum	*Didelphis virginiana*
Mammalia	**m002**	**Mt. Lyell Shrew**	***Sorex lyelli***
Mammalia	**m003**	**Vagrant Shrew**	***Sorex vagrans***
Mammalia	m004	Montane Shrew	*Sorex monticolus*
Mammalia	m005	Fog Shrew	*Sorex sonomae*
Mammalia	**m006**	**Ornate Shrew**	***Sorex ornatus***
Mammalia	m008	Inyo Shrew	*Sorex tenellus*
Mammalia	m010	Water Shrew	*Sorex palustris*
Mammalia	m011	Marsh Shrew	*Sorex bendirii*
Mammalia	m012	Trowbridge's Shrew	*Sorex trowbridgii*
Mammalia	m013	Merriam's Shrew	*Sorex merriami*
Mammalia	m014	Desert Shrew	*Notiosorex crawfordi*
Mammalia	m015	Shrew-Mole	*Neurotrichus gibbsii*
Mammalia	m016	Townsend's Mole	*Scapanus townsendii*
Mammalia	m017	Coast Mole	*Scapanus orarius*

**Bold row indicates a Species of Special Concern in California.*

Table 12 (continued).

Class	Species ID	Common name	Scientific name
Mammalia	**m018**	**Broad-footed Mole**	***Scapanus latimanus***
Mammalia	**m019**	**California Leaf-nosed Bat**	***Macrotus californicus***
Mammalia	**m020**	**Hog-nosed Bat**	***Choeronycteris mexicana***
Mammalia	m021	Little Brown Bat	*Myotis lucifugus*
Mammalia	**m022**	**Arizona Myotis**	***Myotis occultus***
Mammalia	m023	Yuma Myotis	*Myotis yumanensis*
Mammalia	**m024**	**Cave Myotis**	***Myotis velifer***
Mammalia	m025	Long-eared Myotis	*Myotis evotis*
Mammalia	m026	Fringed Myotis	*Myotis thysanodes*
Mammalia	m027	Long-legged Myotis	*Myotis volans*
Mammalia	m028	California Myotis	*Myotis californicus*
Mammalia	m029	Small-footed Myotis	*Myotis ciliolabrum*
Mammalia	m030	Silver-haired Bat	*Lasionycteris noctivagans*
Mammalia	m031	Canyon Bat	*Parastrelluss hesperus*
Mammalia	m032	Big Brown Bat	*Eptesicus fuscus*
Mammalia	**m033**	**Western Red Bat**	***Lasiurus blossevillii***
Mammalia	m034	Hoary Bat	*Lasiurus cinereus*
Mammalia	**m035**	**Western Yellow Bat**	***Lasiurus xanthinus***
Mammalia	**m036**	**Spotted Bat**	***Euderma maculatum***
Mammalia	**m037**	**Townsend's Big-eared Bat**	***Corynorhinus townsendii***
Mammalia	**m038**	**Pallid Bat**	***Antrozous pallidus***
Mammalia	m039	Brazilian Free-tailed Bat	*Tadarida brasiliensis*
Mammalia	**m040**	**Pocketed Free-tailed Bat**	***Nyctinomops femorosaccus***
Mammalia	**m041**	**Big Free-tailed Bat**	***Nyctinomops macrotis***
Mammalia	**m042**	**Western Mastiff Bat**	***Eumops perotis***
Mammalia	m043	American Pika	*Ochotona princeps*
Mammalia	**m044**	**Pygmy Rabbit**	***Brachylagus idahoensis***
Mammalia	m045	Brush Rabbit	*Sylvilagus bachmani*
Mammalia	m046	Nuttall's Cottontail	*Sylvilagus nuttallii*
Mammalia	m047	Audubon's Cottontail	*Sylvilagus audubonii*
Mammalia	**m049**	**Snowshoe Hare**	***Lepus americanus***
Mammalia	**m050**	**White-tailed Jackrabbit**	***Lepus townsendii***
Mammalia	**m051**	**Black-tailed Jackrabbit**	***Lepus californicus***
Mammalia	**m052**	**Mountain Beaver**	***Aplodontia rufa***
Mammalia	m053	Alpine Chipmunk	*Tamias alpinus*

**Bold row indicates a Species of Special Concern in California.*

Table 12 (continued).

Class	Species ID	Common name	Scientific name
Mammalia	m054	Least Chipmunk	*Tamias minimus*
Mammalia	m055	Yellow-pine Chipmunk	*Tamias amoenus*
Mammalia	m056	Redwood Chipmunk	*Tamias ochrogenys*
Mammalia	m057	Shadow Chipmunk	*Tamias senex*
Mammalia	m058	Siskiyou Chipmunk	*Tamias siskiyou*
Mammalia	m059	Sonoma Chipmunk	*Tamias sonomae*
Mammalia	m060	Merriam's Chipmunk	*Tamias merriami*
Mammalia	m061	Chaparral Chipmunk	*Tamias obscurus*
Mammalia	m062	Long-eared Chipmunk	*Tamias quadrimaculatus*
Mammalia	m063	Lodgepole Chipmunk	*Tamias speciosus*
Mammalia	m064	Panamint Chipmunk	*Tamias panamintinus*
Mammalia	m065	Uinta Chipmunk	*Tamias umbrinus*
Mammalia	m066	Yellow-bellied Marmot	*Marmota flaviventris*
Mammalia	m067	White-tailed Antelope Ground Squirrel	*Ammospermophilus leucurus*
Mammalia	m068	Nelson's Antelope Ground Squirrel	*Ammospermophilus nelsoni*
Mammalia	m069	Piute Ground Squirrel	*Urocitellus mollis*
Mammalia	m070	Belding's Ground Squirrel	*Urocitellus beldingi*
Mammalia	m071	Rock Squirrel	*Ostospermophilus variegatus*
Mammalia	m072	California Ground Squirrel	*Ostospermophilus beecheyi*
Mammalia	m073	Mohave Ground Squirrel	*Xerospermophilus mohavensis*
Mammalia	**m074**	**Round-tailed Ground Squirrel**	***Xerospermophilus tereticaudus***
Mammalia	m075	Golden-mantled Ground Squirrel	*Callospermophilus lateralis*
Mammalia	m076	Eastern Gray Squirrel	*Sciurus carolinensis*
Mammalia	m077	Western Gray Squirrel	*Sciurus griseus*
Mammalia	m078	Eastern Fox Squirrel	*Sciurus niger*
Mammalia	m079	Douglas' Squirrel	*Tamiasciurus douglasii*
Mammalia	**m080**	**Northern Flying Squirrel**	***Glaucomys sabrinus***
Mammalia	m081	Botta's Pocket Gopher	*Thomomys bottae*
Mammalia	m082	Townsend's Pocket Gopher	*Thomomys townsendii*
Mammalia	m083	Northern Pocket Gopher	*Thomomys talpoides*
Mammalia	m084	Mazama Pocket Gopher	*Thomomys mazama*
Mammalia	m085	Mountain Pocket Gopher	*Thomomys monticola*
Mammalia	**m086**	**Little Pocket Mouse**	***Perognathus longimembris***
Mammalia	**m087**	**San Joaquin Pocket Mouse**	***Perognathus inornatus***
Mammalia	m088	Great Basin Pocket Mouse	*Perognathus parvus*

**Bold row indicates a Species of Special Concern in California.*

Table 12 (continued).

Class	Species ID	Common name	Scientific name
Mammalia	**m089**	**White-eared Pocket Mouse**	***Perognathus alticolus***
Mammalia	m091	Long-tailed Pocket Mouse	*Chaetodipus formosus*
Mammalia	m092	Bailey's Pocket Mouse	*Chaetodipus rudinoris*
Mammalia	m093	Desert Pocket Mouse	*Chaetodipus penicillatus*
Mammalia	**m094**	**San Diego Pocket Mouse**	***Chaetodipus fallax***
Mammalia	**m095**	**California Pocket Mouse**	***Chaetodipus californicus***
Mammalia	m096	Spiny Pocket Mouse	*Chaetodipus spinatus*
Mammalia	m097	Dark Kangaroo Mouse	*Microdipodops megacephalus*
Mammalia	m098	Pale Kangaroo Mouse	*Microdipodops pallidus*
Mammalia	m099	Ord's Kangaroo Rat	*Dipodomys ordii*
Mammalia	m100	Chisel-toothed Kangaroo Rat	*Dipodomys microps*
Mammalia	**m102**	**Narrow-faced Kangaroo Rat**	***Dipodomys venustus***
Mammalia	m103	Agile Kangaroo Rat	*Dipodomys agilis*
Mammalia	m104	Heermann's Kangaroo Rat	*Dipodomys heermanni*
Mammalia	**m105**	**California Kangaroo Rat**	***Dipodomys californicus***
Mammalia	m106	Giant Kangaroo Rat	*Dipodomys ingens*
Mammalia	m107	Panamint Kangaroo Rat	*Dipodomys panamintinus*
Mammalia	m108	Stephens' Kangaroo Rat	*Dipodomys stephensi*
Mammalia	m109	Desert Kangaroo Rat	*Dipodomys deserti*
Mammalia	**m110**	**Merriam's Kangaroo Rat**	***Dipodomys merriami***
Mammalia	**m111**	**Fresno Kangaroo Rat**	***Dipodomys nitratoides***
Mammalia	m112	American Beaver	*Castor canadensis*
Mammalia	m113	Western Harvest Mouse	*Reithrodontomys megalotis*
Mammalia	m114	Salt-marsh Harvest Mouse	*Reithrodontomys raviventris*
Mammalia	m115	Cactus Mouse	*Peromyscus eremicus*
Mammalia	m116	California Mouse	*Peromyscus californicus*
Mammalia	**m117**	**Deer Mouse**	***Peromyscus maniculatus***
Mammalia	m118	Canyon Mouse	*Peromyscus crinitus*
Mammalia	m119	Brush Mouse	*Peromyscus boylii*
Mammalia	m120	Pinyon Mouse	*Peromyscus truei*
Mammalia	m121	Northern Grasshopper Mouse	*Onychomys leucogaster*
Mammalia	**m122**	**Southern Grasshopper Mouse**	***Onychomys torridus***
Mammalia	**m123**	**Hispid Cotton Rat**	***Sigmodon hispidus***
Mammalia	**m124**	**Arizona Cotton Rat**	***Sigmodon arizonae***
Mammalia	m125	White-throated Woodrat	*Neotoma albigula*

**Bold row indicates a Species of Special Concern in California.*

Table 12 (continued).

Class	Species ID	Common name	Scientific name
Mammalia	**m126**	**Desert Woodrat**	***Neotoma lepida***
Mammalia	**m127**	**Dusky-footed Woodrat**	***Neotoma fuscipes***
Mammalia	m128	Bushy-tailed Woodrat	*Neotoma cinerea*
Mammalia	m129	California Red-backed Vole	*Myodes californicus*
Mammalia	m130	Heather Vole	*Phenacomys intermedius*
Mammalia	**m131**	**White-footed Vole**	***Arborimus albipes***
Mammalia	**m132**	**Sonoma Tree Vole**	***Arborimus pomo***
Mammalia	m133	Montane Vole	*Microtus montanus*
Mammalia	**m134**	**California Vole**	***Microtus californicus***
Mammalia	m135	Townsend's Vole	*Microtus townsendii*
Mammalia	m136	Long-tailed Vole	*Microtus longicaudus*
Mammalia	m137	Creeping Vole	*Microtus oregoni*
Mammalia	m138	Sagebrush Vole	*Lemmiscus curtatus*
Mammalia	m139	Common Muskrat	*Ondatra zibethicus*
Mammalia	m140	Black Rat	*Rattus rattus*
Mammalia	m141	Norway Rat	*Rattus norvegicus*
Mammalia	m142	House Mouse	*Mus musculus*
Mammalia	m143	Western Jumping Mouse	*Zapus princeps*
Mammalia	**m144**	**Pacific Jumping Mouse**	***Zapus trinotatus***
Mammalia	m145	Common Porcupine	*Erethizon dorsatum*
Mammalia	m146	Coyote	*Canis latrans*
Mammalia	m147	Red Fox	*Vulpes vulpes*
Mammalia	m148	Kit Fox	*Vulpes macrotis*
Mammalia	m149	Gray Fox	*Urocyon cinereoargenteus*
Mammalia	m150	Island Gray Fox	*Urocyon littoralis*
Mammalia	m151	Black Bear	*Ursus americanus*
Mammalia	m152	Ringtail	*Bassariscus astutus*
Mammalia	m153	Raccoon	*Procyon lotor*
Mammalia	**m154**	**Marten**	***Martes caurina***
Mammalia	**m155**	**Fisher**	***Pekania pennanti***
Mammalia	m156	Ermine	*Mustela erminea*
Mammalia	m157	Long-tailed Weasel	*Mustela frenata*
Mammalia	m158	American Mink	*Mustela vison*
Mammalia	m159	Wolverine	*Gulo gulo*
Mammalia	**m160**	**American Badger**	***Taxidea taxus***

**Bold row indicates a Species of Special Concern in California.*

Table 12 (continued).

Class	Species ID	Common name	Scientific name
Mammalia	**m161**	**Western Spotted Skunk**	***Spilogale gracilis***
Mammalia	m162	Striped Skunk	*Mephitis mephitis*
Mammalia	**m163**	**Northern River Otter**	***Lontra canadensis***
Mammalia	m164	Sea Otter	*Enhydra lutris*
Mammalia	**m165**	**Mountain Lion**	***Puma concolor***
Mammalia	m166	Bobcat	*Lynx rufus*
Mammalia	m167	Northern Fur-Seal	*Callorhinus ursinus*
Mammalia	m168	Guadalupe Fur-Seal	*Arctocephalus townsendi*
Mammalia	m169	Northern (Steller) Sea-Lion	*Eumetopias jubatus*
Mammalia	m170	California Sea-Lion	*Zalophus californianus*
Mammalia	m171	Harbor Seal	*Phoca vitulina*
Mammalia	m173	Northern Elephant Seal	*Mirounga angustirostris*
Mammalia	m174	Feral Horse	*Equus caballus*
Mammalia	m175	Feral Ass	*Equus asinus*
Mammalia	m176	Wild Pig	*Sus scrofa*
Mammalia	m177	Elk	*Cervus elaphus*
Mammalia	m178	Fallow Deer	*Dama dama*
Mammalia	m179	Sambar Deer	*Cervus unicolor*
Mammalia	m180	Axis Deer	*Axis axis*
Mammalia	m181	Mule Deer	*Odocoileus hemionus*
Mammalia	m182	Pronghorn	*Antilocapra americana*
Mammalia	m183	Bighorn Sheep	*Ovis canadensis*
Mammalia	m184	Barbary Sheep	*Ammotragus lervia*
Mammalia	m185	Himalayan Tahr	*Hemitragus jemlahicus*
Mammalia	m186	Feral Goat	*Capra hircus*
Mammalia	**m233**	**Big-eared Woodrat**	***Neotoma macrotis***
Mammalia	m234	Baja Mouse	*Peromyscus fraterculus*
Reptilia	**r002**	**Sonoran Mud Turtle**	***Kinosternon sonoriense***
Reptilia	r003	Pond Slider	*Trachemys scripta*
Reptilia	**r004**	**Western Pond Turtle**	***Actinemys marmorata***
Reptilia	r005	Desert Tortoise	*Gopherus agassizii*
Reptilia	r006	Spiny Softshell	*Apalone spinifera*
Reptilia	r007	Switak's Banded Gecko	*Coleonyx switaki*
Reptilia	r008	Western Banded Gecko	*Coleonyx variegatus*
Reptilia	r009	Peninsular Leaf-toed Gecko	*Phyllodactylus nocticolus*

**Bold row indicates a Species of Special Concern in California.*

Table 12 (continued).

Class	Species ID	Common name	Scientific name
Reptilia	r010	Desert Iguana	*Dipsosaurus dorsalis*
Reptilia	r011	Common Chuckwalla	*Sauromalus ater*
Reptilia	r012	Zebra-tailed Lizard	*Callisaurus draconoides*
Reptilia	**r013**	**Colorado Desert Fringe-toed Lizard**	***Uma notata***
Reptilia	r014	Coachella Fringe-toed Lizard	*Uma inornata*
Reptilia	**r015**	**Mojave Fringe-toed Lizard**	***Uma scoparia***
Reptilia	r017	Great Basin Collared Lizard	*Crotaphytus bicinctores*
Reptilia	r018	Long-nosed Leopard Lizard	*Gambelia wislizenii*
Reptilia	r019	Blunt-nosed Leopard Lizard	*Gambelia sila*
Reptilia	r020	Desert Spiny Lizard	*Sceloporus magister*
Reptilia	r021	Granite Spiny Lizard	*Sceloporus orcutti*
Reptilia	r022	Western Fence Lizard	*Sceloporus occidentalis*
Reptilia	r023	Common Sagebrush Lizard	*Sceloporus graciosus*
Reptilia	r024	Common Side-blotched Lizard	*Uta stansburiana*
Reptilia	r025	Long-tailed Brush Lizard	*Urosaurus graciosus*
Reptilia	r026	Ornate Tree Lizard	*Urosaurus ornatus*
Reptilia	r027	Baja California Brush Lizard	*Urosaurus nigricaudus*
Reptilia	r028	Mearns' Rock Lizard	*Petrosaurus mearnsi*
Reptilia	**r029**	**Blainville's Horned Lizard**	***Phrynosoma blainvillii***
Reptilia	r030	Desert Horned Lizard	*Phrynosoma platyrhinos*
Reptilia	r031	Pygmy Short-horned Lizard	*Phrynosoma douglassii*
Reptilia	**r032**	**Flat-tailed Horned Lizard**	***Phrynosoma mcallii***
Reptilia	r033	Henshaw's Night Lizard	*Xantusia henshawi*
Reptilia	**r034**	**Desert Night Lizard**	***Xantusia vigilis***
Reptilia	r035	Island Night Lizard	*Xantusia riversiana*
Reptilia	**r036**	**Western Skink**	***Plestiodon skiltonianus***
Reptilia	r037	Gilbert's Skink	*Plestiodon gilberti*
Reptilia	**r038**	**Orange-throated Whiptail**	***Aspidoscelis hyperythra***
Reptilia	r039	Tiger Whiptail	*Aspidoscelis tigris*
Reptilia	r040	Southern Alligator Lizard	*Elgaria multicarinata*
Reptilia	**r041**	**Panamint Alligator Lizard**	***Elgaria panamintina***
Reptilia	r042	Northern Alligator Lizard	*Elgaria coerulea*
Reptilia	**r043**	**California Legless Lizard**	***Anniella pulchra***
Reptilia	**r044**	**Gila Monster**	***Heloderma suspectum***
Reptilia	r045	Western Threadsnake	*Rena humilis*

**Bold row indicates a Species of Special Concern in California.*

Table 12 (continued).

Class	Species ID	Common name	Scientific name
Reptilia	r046	Northern Rubber Boa	*Charina bottae*
Reptilia	r047	Rosy Boa	*Lithanura trivirgata*
Reptilia	r048	Ring-necked Snake	*Diadophis punctatus*
Reptilia	r049	Common Sharp-tailed Snake	*Contia tenuis*
Reptilia	r050	Spotted Leaf-nosed Snake	*Phyllorhynchus decurtatus*
Reptilia	r051	North American Racer	*Coluber constrictor*
Reptilia	**r052**	**Coachwhip**	***Coluber flagellum***
Reptilia	r053	Striped Racer	*Coluber lateralis*
Reptilia	r054	Striped Whipsnake	*Coluber taeniatus*
Reptilia	**r055**	**Western Patch-nosed Snake**	***Salvadora hexalepis***
Reptilia	r056	Glossy Snake	*Arizona elegans*
Reptilia	**r057**	**Gophersnake**	***Pituophis catenifer***
Reptilia	r058	Eastern Kingsnake	*Lampropeltis getula*
Reptilia	**r059**	**California Mountain Kingsnake**	***Lampropeltis zonata***
Reptilia	r060	Long-Nosed Snake	*Rhinocheilus lecontei*
Reptilia	**r061**	**Common Gartersnake**	***Thamnophis sirtalis***
Reptilia	r062	Terrestrial Gartersnake	*Thamnophis elegans*
Reptilia	r063	Western Aquatic Garter Snake	*Thamnophis couchii*
Reptilia	r064	Northwestern Gartersnake	*Thamnophis ordinoides*
Reptilia	r065	Checkered Gartersnake	*Thamnophis marcianus*
Reptilia	r066	Western Groundsnake	*Sonora semiannulata*
Reptilia	r067	Western Shovel-nosed Snake	*Chionactis occipitalis*
Reptilia	r068	Western Black-headed Snake	*Tantilla planiceps*
Reptilia	r069	Smith's Black-headed Snake	*Tantilla hobartsmithi*
Reptilia	r070	Sonoran Lyresnake	*Trimorphodon lambda*
Reptilia	r071	Desert Nightsnake	*Hypsiglena chlorophaea*
Reptilia	r072	Western Diamond-backed Rattlesnake	*Crotalus atrox*
Reptilia	**r073**	**Red Diamond Rattlesnake**	***Crotalus ruber***
Reptilia	r074	Speckled Rattlesnake	*Crotalus mitchellii*
Reptilia	r075	Sidewinder	*Crotalus cerastes*
Reptilia	r076	Western Rattlesnake	*Crotalus oreganus*
Reptilia	r077	Mojave Rattlesnake	*Crotalus scutulatus*
Reptilia	r078	Aquatic Gartersnake	*Thamnophis atratus*
Reptilia	r079	Giant Gartersnake	*Thamnophis gigas*
Reptilia	**r080**	**Two-striped Gartersnake**	***Thamnophis hammondii***

**Bold row indicates a Species of Special Concern in California.*

Table 12 (continued).

Class	Species ID	Common name	Scientific name
Reptilia	r093	Baja Black-collared Lizard	*Crotaphytus vestigium*
Reptilia	**r094**	**Sandstone Night Lizard**	***Xantusia gracilis***
Reptilia	r095	Southern Rubber Boa	*Charina umbratica*
Reptilia	r096	Cope's Leopard Lizard	*Gambelia copeii*
Reptilia	r098	Baja California Coachwhip	*Coluber fuliginosus*
Reptilia	r099	Sierra Night Lizard	*Xantusia sierrae*
Reptilia	r100	Panamint Rattlesnake	*Crotalus stephensi*
Reptilia	r101	Forest Sharp-tailed Snake	*Contia longicauda*
Reptilia	r102	California Lyresnake	*Trimorphodon lyrophanes*
Reptilia	r105	Northern Three-lined Boa	*Lichanura orcutti*
Reptilia	r106	Coast Nightsnake	*Hypsiglena ochrorhyncha*
Reptilia	r107	Yellow-backed Spiny Lizard	*Sceloporus uniformis*
Reptilia	r108	Wiggins' Night Lizard	*Xantusia wigginsi*

**Bold row indicates a Species of Special Concern in California.*

Table 13. Percentage coverage by protected area type for habitat types.

Habitat code	Habitat category	CA	Ballot	CDFW	TNC
0	Tree Dominated	12.55	0.00	8.91	1.70
1	Tree Dominated	12.39	0.00	3.81	1.68
2	Tree Dominated	12.00	0.00	3.67	1.45
3	Tree Dominated	21.48	1.48	11.25	17.63
4	Tree Dominated	21.42	0.00	5.32	5.11
5	Tree Dominated	5.60	0.00	0.09	0.43
6	Tree Dominated	17.62	45.94	5.10	10.47
7	Tree Dominated	18.37	0.00	8.33	5.35
8	Tree Dominated	16.08	30.63	2.79	8.93
9	Tree Dominated	7.54	0.00	4.14	3.10
10	Tree Dominated	4.90	68.95	3.90	10.06
11	Tree Dominated	11.14	0.00	19.29	3.65
12	Tree Dominated	48.70	1.06	61.78	43.25
13	Tree Dominated	18.87	0.00	8.02	1.71
14	Tree Dominated	12.03	39.57	5.33	13.57
15	Tree Dominated	30.55	69.41	20.06	38.45
16	Tree Dominated	30.26	78.99	19.49	52.92
17	Tree Dominated	14.86	14.83	18.45	51.64
18	Tree Dominated	20.52	42.98	23.12	50.21
19	Tree Dominated	16.76	87.00	17.00	32.97
20	Tree Dominated	16.00	13.20	14.85	47.33
21	Tree Dominated	22.44	55.14	26.97	35.85
22	Tree Dominated	44.92	92.00	41.35	20.77
23	Tree Dominated	43.87	99.85	68.28	81.77
24	Tree Dominated	26.70	0.00	14.99	0.56
25	Tree Dominated	3.35	0.00	2.40	0.36
26	Tree Dominated	15.01	0.00	9.78	0.21
27	Shrub Dominated	7.31	0.00	3.11	0.69
28	Shrub Dominated	14.93	0.00	15.92	3.37
29	Shrub Dominated	12.00	0.00	13.28	3.37
30	Shrub Dominated	14.93	0.00	15.92	3.37
31	Shrub Dominated	29.10	36.29	17.82	28.85
32	Shrub Dominated	35.80	64.91	43.21	58.38
33	Shrub Dominated	27.84	58.66	33.84	34.98

Table 13 (continued).

Habitat code	Habitat category	CA	Ballot	CDFW	TNC
34	Shrub Dominated	15.90	43.90	15.72	28.89
35	Shrub Dominated	11.23	0.00	17.60	0.21
36	Shrub Dominated	25.15	0.00	24.38	0.61
37	Shrub Dominated	25.82	0.55	29.33	8.79
38	Shrub Dominated	26.18	0.00	22.87	0.73
39	Herbaceous Dominated	99.69	99.85	98.30	99.96
40	Herbaceous Dominated	99.69	99.85	98.30	99.96
41	Herbaceous Dominated	40.55	57.68	25.63	20.98
42	Herbaceous Dominated	99.69	99.85	98.30	99.96
43	Herbaceous Dominated	0.95	1.43	8.26	1.98
44	Herbaceous Dominated	27.13	16.51	40.51	32.03
45	Aquatic	99.69	99.85	98.30	99.96
46	Aquatic	99.69	99.85	98.30	99.96
47	Aquatic	1.08	1.43	8.26	7.07
50	Developed	17.60	2.77	24.54	32.22
51	Developed	13.06	0.09	18.95	25.98
52	Developed	15.63	0.09	27.19	20.71
53	Developed	23.37	10.60	28.88	26.70
54	Developed	5.24	0.04	12.03	9.28
56	Developed	12.32	6.92	15.63	25.39
57	Developed	9.67	2.70	16.51	11.85
58	Developed	15.46	32.13	22.90	26.79
59	Developed	99.69	99.85	98.30	99.96
60	Non-vegetated	99.69	99.85	98.30	99.96

Table 14. Percentage coverage by protected area type for species.

Species ID	CA	Ballot	CDFW	TNC
a001	**15.05**	**27.32**	**14.02**	**39.14**
a002	3.96	0.13	2.99	1.13
a003	5.41	0.00	1.17	1.49
a004	2.56	71.50	4.87	3.62
a005	**3.84**	**0.00**	**2.47**	**0.93**
a006	16.20	93.53	13.07	28.71
a007	**14.27**	**46.83**	**14.15**	**32.05**
a008	1.93	25.98	1.12	8.89
a009	0.10	0.00	0.00	0.00
a010	**2.11**	**0.00**	**0.97**	**0.00**
a011	0.24	0.00	0.02	0.00
a012	**40.52**	**97.31**	**29.28**	**57.82**
a013	3.99	2.70	7.01	3.46
a014	15.71	96.34	16.10	37.29
a015	8.37	0.81	8.08	15.03
a016	0.12	0.00	0.00	10.72
a017	0.19	0.00	0.00	0.00
a018	0.32	0.00	0.00	1.22
a019	**0.23**	**0.00**	**0.00**	**0.00**
a020	12.00	37.70	7.14	10.13
a021	1.07	0.00	0.74	0.00
a022	21.46	99.76	18.51	40.11
a023	**4.37**	**0.00**	**0.18**	**0.00**
a024	0.78	0.00	0.00	0.43
a025	0.13	0.00	0.01	0.00
a026	**8.65**	**0.00**	**2.32**	**1.55**
a027	**2.04**	**0.00**	**0.50**	**0.00**
a028	**24.02**	**4.12**	**34.49**	**37.20**
a029	7.59	0.00	8.48	0.00
a030	**0.95**	**0.00**	**1.09**	**0.00**
a031	0.07	0.00	0.08	0.00
a032	77.52	99.85	78.37	88.70
a033	**2.26**	**0.00**	**0.21**	**0.00**

**Bold row indicates a Species of Special Concern in California.*

Table 14 (continued).

Species ID	CA	Ballot	CDFW	TNC
a034	1.25	0	2.15	0.44
a035	**5.48**	**1.72**	**6.51**	**1.04**
a036	23.56	0	25.13	0.77
a037	1.84	0	2.4	0.36
a038	8.63	2.22	21.14	3.81
a039	1.13	0	0.74	0
a040	**2.08**	**0**	**2.9**	**1.11**
a041	**0.61**	**0**	**0.54**	**0**
a042	**1.94**	**0**	**0.21**	**0.53**
a043	**29.7**	**79.51**	**19.63**	**60.43**
a044	**2.71**	**0**	**0.23**	**0.03**
a045	**1.63**	**0**	**2.84**	**0.08**
a046	57.02	99.85	73.56	80.37
a047	1.38	0	1.99	7.02
a048	11.38	18.76	3.96	10.1
a049	**0.38**	**0**	**0**	**0**
a050	1.54	0	0.95	0.16
a053	0.37	0	0.01	0
a054	0.01	0	0	0
a056	2.53	0	0.48	4.23
a057	1.25	0.48	0.77	1.33
a058	0.06	0	0	0
a059	0.18	0	0	0.27
a060	1.54	0	0.18	0
a061	0.18	0	0.02	0
a062	1.35	0	0.1	0
a063	0.72	0	0.03	0
a066	**2.04**	**0.51**	**2.65**	**0.77**
a067	0.11	0	0	0
a068	4.12	18.96	3.02	9.65
a070	**6.9**	**0**	**0.66**	**0.76**
a071	**22.89**	**82.35**	**26.44**	**70.61**
a073	0.11	0	0	0

**Bold row indicates a Species of Special Concern in California.*

Table 14 (continued).

Species ID	CA	Ballot	CDFW	TNC
a074	0.34	0	0	0
a075	8.31	0	6.21	18.7
a076	15.83	2.7	24.7	22.82
a077	60.35	97.15	60.91	76.8
a078	0.22	0	0.05	0
b001	0.24	0	0.22	10.72
b002	0.24	0	0.22	10.72
b003	**4.34**	**0.22**	**5.46**	**14.13**
b006	81.08	74.13	95.23	89.44
b007	1.84	0.09	4.19	10.73
b008	0.31	0.09	1.49	0.02
b009	78.03	99.85	81.32	84.68
b010	51.69	97.32	58.12	73.6
b042	**45.57**	**61.06**	**64.71**	**42.79**
b043	1.38	0	2.32	11.08
b044	33.54	84.97	43.8	67.77
b046	0.24	0	0.22	10.72
b047	0.24	0	0.22	10.72
b049	59.7	75.72	66.87	59.19
b050	**8.56**	**2.47**	**16.59**	**5.31**
b051	95.47	99.95	96.45	99.97
b052	34.82	58.65	43.78	45.92
b053	36.88	50.04	47.05	66.65
b057	29.09	50.5	39.83	58.17
b058	70.84	99.85	71.53	84.14
b059	66.26	99.85	79.5	74.77
b062	2.56	0	6.17	7.42
b065	**1.02**	**0**	**0.85**	**0**
b067	25.71	14.83	40.68	39.51
b070	**21.02**	**0.09**	**28.98**	**20.37**
b071	18.69	46.63	29.38	17.04
b072	14.31	29.23	26.58	22.38
b074	**0**	**0**	**0.2**	**0**

**Bold row indicates a Species of Special Concern in California.*

Table 14 (continued).

Species ID	CA	Ballot	CDFW	TNC
b075	49.45	86.46	74.89	71.85
b076	61.14	99.34	60.84	97.92
b077	83.4	99.85	95.88	87.34
b079	98.53	99.85	98.3	99.98
b080	85.05	99.85	93.14	98
b082	32.86	40.11	37.16	21.86
b083	63.53	85.97	71.88	59.23
b084	74.56	62.27	84.82	74.14
b085	75.39	54.04	87.27	74.19
b086	19.48	59.66	32.41	35.63
b087	50.42	85.97	64.77	60.86
b089	46.05	62.27	62.73	85.52
b090	**22.78**	**13.46**	**39.93**	**12.94**
b091	98.27	99.85	98.3	89.26
b093	4.6	0.09	7.37	2.11
b094	88.31	99.85	93.73	94.9
b096	**2.61**	**0**	**0.69**	**0**
b097	2.55	9.08	6.21	1.22
b098	0.26	0.09	1.51	0.02
b099	0.26	0.09	1.51	0.02
b100	0.48	0.09	1.51	0.02
b101	40.14	57.99	44.32	49.57
b102	**4.54**	**56.66**	**7.41**	**1.9**
b103	75.78	99.85	87.08	99.78
b104	54.08	98.75	48.3	77.23
b105	64.31	99.3	69.97	76.18
b106	7.45	0.04	10.35	16.3
b107	69.55	99.85	82.94	94.66
b108	90.28	99.85	94.03	84.71
b109	5.34	0	6.27	7.71
b110	60.69	97.74	57.06	68.61
b111	46.94	99.85	60.43	81.88
b113	74.13	99.85	74.2	99.37

**Bold row indicates a Species of Special Concern in California.*

Table 14 (continued).

Species ID	CA	Ballot	CDFW	TNC
b114	**77.84**	**95.87**	**95.1**	**87.16**
b115	94.1	99.85	96.76	85.82
b116	97.73	99.85	98.04	99.95
b117	**33.94**	**3.97**	**22.36**	**4.89**
b119	60.69	98.32	74.8	64.41
b121	21.45	0.09	27.35	32.27
b123	99.73	99.85	98.5	99.98
b124	74.17	61.06	80.45	66.16
b125	64.76	87.99	83.54	94.68
b126	98.07	99.85	96.67	89.23
b127	98.49	99.85	98.3	99.98
b128	91.12	99.85	96.62	99.44
b129	74.76	99.85	74.94	99.54
b131	81.02	74.67	90.1	74.53
b132	26.84	0	23.75	7.95
b133	20.48	13.6	32.08	49.7
b134	**24.94**	**22.24**	**7.23**	**11.71**
b135	0.47	0	0.05	0
b136	6.6	0	2.91	0
b137	**3.37**	**0**	**6.35**	**0**
b138	23.35	79.96	25.01	52.12
b139	18.45	0	15.23	0.5
b140	**72.42**	**99.85**	**85.04**	**97.71**
b141	43.25	53.25	34.09	36.24
b143	1.93	3.44	5.81	2.99
b144	2.3	2.74	5.7	0.42
b145	45.22	69.27	57.19	60.96
b146	42.61	64.26	70.55	78.3
b148	42.93	68.94	58.13	75.04
b149	99.98	99.95	99.78	100
b150	**22.07**	**0.04**	**29.05**	**20.3**
b151	11.06	1.94	17.85	29.91
b154	**10.36**	**44.44**	**16.23**	**23.52**

**Bold row indicates a Species of Special Concern in California.*

Table 14 (continued).

Species ID	CA	Ballot	CDFW	TNC
b156	3.5	17.77	4.94	1.63
b158	97.34	99.95	99.23	99.85
b159	**7.61**	**0.26**	**13.7**	**3.61**
b162	0.01	0	0.2	0
b163	23.03	18.02	36.22	22.12
b164	27.11	36.99	39.38	28.77
b165	21.96	35.6	38.61	57.54
b166	2.08	0.76	6.69	0.12
b168	13.5	22.77	24.11	16.21
b169	3.93	19.9	3.98	18.08
b170	63.95	96.57	63.91	66.11
b172	0.68	0.3	1.67	10.83
b173	24.47	58	35.36	28.51
b176	3.79	17.16	8.39	1.28
b177	0.58	0.55	2.09	10.82
b178	0.48	0.09	1.49	10.73
b179	0.25	0	0.27	10.72
b180	0.81	0.41	2.22	0.78
b181	1.23	0.51	3.13	11.05
b183	9.1	15.02	17.69	19.67
b185	62.41	99.95	80.68	95.24
b190	0	0	0.06	0
b191	16.77	19.06	27.78	45.77
b193	0.17	0	0.67	0
b196	1.21	0.86	3.89	0.17
b197	23.81	31.76	38.03	45.15
b199	71.01	99.95	77.21	88.63
b200	9.23	0.04	10.25	1.91
b211	3.6	38.6	10	4.73
b212	2.95	8.74	2.41	12.12
b213	8.36	62.36	17.71	27.63
b214	46.89	99.88	59.66	62.7
b215	40.47	77.04	54.16	75.29

**Bold row indicates a Species of Special Concern in California.*

Table 14 (continued).

Species ID	CA	Ballot	CDFW	TNC
b216	18.81	29.43	28.26	41.28
b217	7.24	14.8	16.49	24.33
b219	0.48	0	0.88	0.15
b220	5.14	26.87	8.66	18.01
b221	12.29	60.39	25.24	59.11
b226	**0.06**	**0**	**0**	**0**
b227	9.44	2.22	10.51	8.07
b228	0.23	0	0.3	10.72
b229	0.01	0	0.19	0
b231	2.48	0.84	4.57	0.28
b233	21.52	29.34	38.33	11.27
b234	0.92	0.53	1.52	0.22
b235	**10.57**	**0**	**20.81**	**1.46**
b236	**0.07**	**0**	**0.36**	**0**
b237	1.06	0.8	3.8	10.86
b239	0.13	0	0.2	10.72
b240	0.01	0	0.2	0
b241	0.22	0	0	10.72
b243	0.01	0	0.2	0
b244	**0.24**	**0**	**0.22**	**10.72**
b247	0.24	0	0.22	10.72
b248	**0.12**	**0**	**0.2**	**10.72**
b250	73.77	99.85	88.5	88.55
b251	52.77	98.27	53.26	64.92
b252	0.59	1.06	2.12	0.14
b253	7.27	2.69	7.28	5.04
b254	6.59	0	15.26	0.38
b255	91.43	99.85	98.37	88.3
b256	0.38	0	0.2	0
b257	3.19	0.98	3.63	2.79
b259	1.83	0.49	3.89	2.9
b260	62.16	33.81	73.05	71.06
b262	81.01	99.85	86.59	88.19

**Bold row indicates a Species of Special Concern in California.*

Table 14 (continued).

Species ID	CA	Ballot	CDFW	TNC
b263	28.43	0	11.09	2.34
b264	66.42	99.85	76.81	87.9
b265	97.5	99.85	98.3	89.26
b267	50.84	95.7	33.63	56.42
b268	0.03	0	0	0
b269	**68.34**	**53.58**	**80.33**	**73.87**
b270	**27.2**	**38.14**	**6.42**	**12.48**
b271	10.28	0	2.17	1.68
b272	**85.21**	**99.76**	**81.94**	**81.77**
b273	**31.86**	**40.44**	**45.61**	**48.4**
b274	67.73	99.21	40.06	49.46
b275	43.17	1.58	53.85	47.37
b276	31.27	27.31	20.32	14.17
b277	90.79	73.53	93.96	79.6
b278	0.37	0	0.12	0.01
b279	**4.21**	**0.86**	**1.4**	**0.02**
b281	**26.35**	**59.75**	**10.82**	**12.33**
b282	61.45	78.49	61.03	47
b286	35.04	8.88	41.76	69.36
b287	67.9	99.85	76.11	98.63
b288	32.88	21.42	31.38	17.1
b289	22.73	0	19.5	3.15
b290	2.97	0	0.23	0
b291	13.1	23.43	3.83	9.92
b292	9.73	84.71	9.55	23.27
b293	64.35	99.85	62.36	82.39
b294	56.19	57.79	69	65.08
b296	47.64	97.35	57.9	92.67
b297	2.14	0	0.72	0
b298	32.95	2.7	35.9	4.25
b299	72.26	99.85	82.69	88.7
b300	12.98	0	14.61	5.07
b301	23.37	0	28.14	0.91

**Bold row indicates a Species of Special Concern in California.*

Table 14 (continued).

Species ID	CA	Ballot	CDFW	TNC
b302	46.53	85.59	59.8	76.8
b303	60.86	98.17	63.48	78.98
b304	51.18	96.97	51.07	47.49
b305	25.01	0	17.28	3.48
b306	19.26	0	10.01	3.1
b307	98.6	99.85	98.5	99.98
b308	26.36	75.38	11.13	14.12
b309	**39.7**	**84.24**	**17.98**	**33.76**
b311	57.39	98.49	45.83	64.87
b315	6.46	0.23	3.61	2.4
b317	20.79	0	6.99	2.19
b318	27.29	0	16.89	5.15
b319	10.48	0	15.94	1.7
b320	35.07	99.49	32.36	51.61
b321	59.12	99.85	71.75	96.32
b323	72.8	93.08	84.07	95.9
b324	**0.82**	**0.19**	**0.65**	**0.29**
b326	75.56	68.3	82.61	81.39
b328	0.47	0	1.03	0.36
b331	13.78	2.7	18.93	22.84
b333	72.16	63.78	83.22	76.93
b334	0.59	0	1.9	1.42
b337	73.98	87.99	84.2	98.97
b338	**29.08**	**77.62**	**11.86**	**19.68**
b339	52.9	94.71	48.84	60.84
b340	67.59	97.84	68.29	74.33
b341	63.67	99.85	70.87	87.54
b342	1.81	0	3.98	2.1
b343	71.76	99.85	86.38	88.52
b344	56	97.28	59.75	93.3
b345	6.06	0	3.39	0.73
b346	40.64	84.53	29.21	48.57
b348	59.69	99.85	74.55	87.5

**Bold row indicates a Species of Special Concern in California.*

Table 14 (continued).

Species ID	CA	Ballot	CDFW	TNC
b349	14	0	22.79	1.87
b350	15.52	0	7.62	0.82
b351	10.37	0	13.74	2.37
b352	16.35	21.05	29.43	57.67
b353	50.81	98.32	54	78.19
b354	81.47	98.59	78.12	75.79
b355	3.07	0	1.87	1.42
b356	40.88	1.3	30.39	17.16
b357	19.44	81.65	7.47	18.47
b358	45.41	66.57	53.61	70.81
b359	18.19	0	16.63	0.56
b360	66.27	99.85	72.01	97.95
b361	54.61	96.85	45.21	63.75
b362	52.28	76.47	50.26	67
b363	22.48	62.62	17.8	11.76
b364	57.43	83.65	59.41	74.13
b365	**27.95**	**2.7**	**23.36**	**5.05**
b366	67.24	77.39	65.67	59.25
b367	41.92	50.93	41.64	56.32
b368	**76.47**	**99.85**	**79.78**	**98.19**
b369	67.25	99.85	69.03	98.15
b370	44.31	95.12	40.73	42.58
b372	**48.43**	**99.85**	**61.12**	**85.45**
b373	39.17	57.07	34.33	40.52
b375	63.6	99.53	61.85	85.92
b376	98.71	99.85	98.26	99.98
b377	54.88	47.74	60.13	53.59
b378	12.53	0	14.36	0.43
b380	64.18	99.85	68.97	87.57
b381	49.81	2.62	56.71	71.71
b382	40.36	7.39	37.02	19.11
b385	37.67	96.42	23.54	20.16
b386	65.91	99.85	59.49	98.89

**Bold row indicates a Species of Special Concern in California.*

Table 14 (continued).

Species ID	CA	Ballot	CDFW	TNC
b389	99.73	99.85	98.5	99.98
b390	52.28	99.85	59.01	90.05
b391	54.17	99.81	59.01	77.34
b393	45.16	78.32	55.06	54.8
b394	12.71	0	14.95	0.36
b396	**3.76**	**0**	**4.92**	**0.23**
b398	36.57	99.16	43.99	68.29
b399	**7.92**	**0**	**3.05**	**0.5**
b400	**24.52**	**0**	**25.63**	**0.89**
b404	93.87	99.85	97.98	88.73
b407	66.94	99.85	78.02	98.66
b408	46.29	15.31	53.04	44.8
b409	11.83	0	18.38	14.64
b410	**78.82**	**76.19**	**90.98**	**88.66**
b411	93.69	99.85	98.06	99.45
b413	2.27	1.6	3.26	0.35
b414	**1.48**	**0**	**1.93**	**0.08**
b415	34.59	68.87	21.92	25.18
b417	**39.3**	**97.83**	**43.53**	**70.9**
b418	47.53	96.02	35.15	63.59
b425	65.41	99.85	67.02	98.24
b426	26.57	0.04	12.48	6.97
b427	2.48	0	0.45	0
b428	**0.15**	**0**	**0.1**	**0.17**
b430	**57.68**	**98.36**	**57.71**	**73.69**
b435	96.39	99.85	96.28	99.98
b436	40.37	78.9	24.17	28.29
b437	23.73	98.16	21.28	37.36
b438	33.01	75.68	19.29	17.73
b460	30.41	65.9	15.34	16.59
b461	**58.92**	**99.85**	**74.14**	**97**
b463	35.42	97.49	18.48	25.32
b467	**33.25**	**60.92**	**40.21**	**63.67**

**Bold row indicates a Species of Special Concern in California.*

Table 14 (continued).

Species ID	CA	Ballot	CDFW	TNC
b469	**0.67**	**0**	**1.2**	**0.28**
b471	40.29	51.15	33.08	17.4
b475	67.57	99.85	69.85	98.38
b476	23.38	3.25	33.14	38.36
b477	69.53	99.85	70.78	88.14
b482	33.74	0.29	20.87	2.9
b483	**73.18**	**99.85**	**77.2**	**99.58**
b484	42.68	99.81	51.76	74.55
b485	1.87	0	1.02	0
b487	**22.7**	**71.59**	**23.76**	**57.12**
b489	83.93	99.14	92.5	98.69
b491	28.21	0	36.38	1.79
b493	18.57	9.04	15.45	23.39
b494	**20.65**	**2.7**	**32.46**	**10.65**
b495	51.75	75.18	69.72	97.72
b496	31.56	0	30.44	0.94
b497	**55.9**	**47.01**	**63.36**	**22.94**
b499	**81.79**	**99.85**	**97.39**	**99.53**
b501	**31.26**	**88.38**	**43.64**	**81.67**
b504	70.93	99.85	74.81	99.21
b505	**79.02**	**99.85**	**88.05**	**99.75**
b506	66.43	99.85	77.61	99.19
b509	63.22	99.85	73.54	98.37
b510	91.33	99.85	98.09	99.9
b512	99.27	99.85	98.5	99.98
b514	7.56	0	15.46	2.59
b519	**94.38**	**99.85**	**98.37**	**89.26**
b520	**37.61**	**62.14**	**57.63**	**72.62**
b521	89.2	99.85	97.77	88.46
b522	**31.46**	**1.1**	**39.56**	**22.15**
b524	98.44	99.85	98.5	99.98
b525	2.16	0	1.35	0.15
b527	0.12	0	0.04	0

**Bold row indicates a Species of Special Concern in California.*

Table 14 (continued).

Species ID	CA	Ballot	CDFW	TNC
b528	78.03	99.85	75.91	86.77
b530	40.17	15.1	52.3	30.81
b532	85.41	91.65	96.45	85.47
b533	5.11	0	2.2	0.28
b534	4.34	0	0.8	0
b535	6.58	0	1.25	0.77
b536	50.6	98.59	41.37	56.91
b537	23.56	0	12.49	2.31
b538	85.53	99.85	95.81	98.26
b539	27.33	47.76	10.04	11.98
b542	65.27	97.15	59.36	87.21
b543	75.02	99.85	85.15	99.23
b544	21.99	5.3	30.53	45.91
b545	78.82	99.85	86.62	86.15
b546	37.16	58.97	31.65	36.21
b547	87.02	99.85	96.5	88.44
b548	72.05	99.85	84	88.11
b549	1.92	0	0.48	0
b550	2.09	0	2.39	0
b551	0.06	0	0	10.72
b552	8.87	0	7.17	0
b553	**2.35**	**2.7**	**6.16**	**0.78**
b554	2.53	0	2.27	0
b579	**0.24**	**0**	**0.22**	**10.72**
b580	0.12	0	0.22	0.04
b581	**0.24**	**0**	**0.19**	**10.72**
b584	**0.24**	**0**	**0.19**	**10.72**
b603	**0.04**	**0**	**0**	**0**
b620	2.23	0	2.42	0.36
b629	2.96	2.55	7.85	11.27
b634	0.74	0.03	0.45	10.82
b648	32.14	0.18	30.6	19.94
b649	19.16	0.18	24.21	29.7

**Bold row indicates a Species of Special Concern in California.*

Table 14 (continued).

Species ID	CA	Ballot	CDFW	TNC
b655	1.23	0.1	1.75	0.06
b656	4.76	0.1	3.65	0.06
b699	10.17	16.35	3.51	9.77
b702	8.51	57.1	6.65	15.04
b773	36.98	85.53	35.67	45.13
b798	64.58	99.85	77.17	86.98
b799	80.92	97.99	89.45	83.12
b806	0.03	0	0	0
b809	69.03	97.94	69.28	69.44
b864	0.76	1.49	4.82	0.04
m001	46.69	99.85	52.31	92.24
m002	**1.1**	**0**	**0.54**	**0**
m003	**18.82**	**38.9**	**17.11**	**11.35**
m004	4.35	0	0.19	0.03
m005	4.98	25.92	3.14	9.81
m006	**35.52**	**97.8**	**46.7**	**48.82**
m008	3.33	0	0.81	0
m010	21.32	0	5.06	2.11
m011	3.19	25.84	3.04	9.65
m012	25.32	49.41	10.72	12.96
m013	5.97	0	6.81	0
m014	32.5	2.7	34.87	4.99
m015	17.41	80.43	9.23	12.5
m016	1.03	0	2.71	0
m017	2.89	0	2.95	1.12
m018	**60.22**	**98.67**	**62.55**	**73.16**
m019	**13.57**	**0**	**12.94**	**0.44**
m020	**0.48**	**1.7**	**1.32**	**0.03**
m021	33.59	53.8	20.94	13.49
m022	**2.3**	**0**	**0.51**	**0**
m023	75.9	99.85	78.5	88.7
m024	**1.57**	**0**	**0.33**	**0**
m025	56.05	98.27	57.68	58.21

**Bold row indicates a Species of Special Concern in California.*

Table 14 (continued).

Species ID	CA	Ballot	CDFW	TNC
m026	64.72	99.76	54.23	59.86
m027	69.39	94.18	69.16	50.67
m028	99.68	99.85	98.3	99.98
m029	40.11	3.76	43.58	24.75
m030	42.78	32.35	41.98	28.13
m031	69.96	28.06	77.65	74.96
m032	99.53	99.85	98.3	99.98
m033	**43.85**	**99.85**	**53.23**	**94.77**
m034	75.14	99.85	82.18	99.4
m035	**12**	**2.7**	**24.26**	**4.03**
m036	**60.55**	**2.7**	**57.52**	**27.94**
m037	**96.67**	**99.85**	**97.68**	**99.98**
m038	**99.23**	**99.85**	**98.3**	**99.98**
m039	98.62	99.85	98.27	99.98
m040	**9.24**	**2.7**	**21.48**	**3.97**
m041	**0.24**	**1.19**	**0.09**	**0**
m042	**59.86**	**39.98**	**60.71**	**72.85**
m043	15.23	0	9.54	1.68
m044	**4.38**	**0**	**5.17**	**0**
m045	42.96	99.76	52.5	68.22
m046	13.04	0	13.47	2.56
m047	63.31	40.88	75.64	75.7
m049	**13.83**	**0**	**3.45**	**3.6**
m050	**11.89**	**0**	**11.89**	**1.15**
m051	**92.64**	**99.85**	**96.2**	**88.21**
m052	**15.73**	**0**	**7.98**	**1.3**
m053	1.53	0	0	0
m054	7.58	0	8.56	0
m055	18.81	0	10.45	3.53
m056	2.01	28.8	0.35	9.65
m057	20.91	0	9.05	3.53
m058	1.36	0	1.3	0
m059	9.42	11.94	4.85	0.64

**Bold row indicates a Species of Special Concern in California.*

Table 14 (continued).

Species ID	CA	Ballot	CDFW	TNC
m060	15.49	22.27	10.36	18.47
m061	2.11	0	10.99	0.24
m062	7.98	0	3.6	1.15
m063	8.21	0	3.58	1.59
m064	4.42	0	0.35	0
m065	4.24	0	0.76	0
m066	18.86	0	13.23	1.68
m067	29.88	0	32.18	1.05
m068	4.04	0	9.11	0.01
m069	2.9	0	5.85	0
m070	19.39	0	9.87	1.68
m071	0.63	0	0	0
m072	69	99.85	82.16	88.7
m073	7.25	0	4.25	0.28
m074	**16.09**	**0**	**12.61**	**0.65**
m075	27.76	0	12.77	3.55
m076	1.15	21.89	1.72	0
m077	46.43	92.12	55.29	48.25
m078	7.68	56.03	8.8	7.36
m079	31.73	49.72	15.57	13.35
m080	**24.46**	**0**	**10.74**	**3.24**
m081	85.62	99.85	90.51	87.59
m082	0.7	0	2.97	0
m083	6.9	0	10.24	0
m084	6.49	0	2.75	1.82
m085	9.54	0	3.72	1.68
m086	**30.25**	**1.7**	**32.62**	**3.46**
m087	**18.62**	**3.25**	**23.8**	**33.83**
m088	12.32	0	12.38	1.78
m089	**0.66**	**0**	**0.05**	**0.03**
m091	26.01	0	28.1	0.56
m092	2.07	0	1.72	0
m093	8.65	0	14.16	0.36

**Bold row indicates a Species of Special Concern in California.*

Table 14 (continued).

Species ID	CA	Ballot	CDFW	TNC
m094	**7.9**	**2.7**	**21.4**	**3.65**
m095	**24.29**	**34.94**	**33.92**	**38.23**
m096	7.47	0	14.73	0.36
m097	1.73	0	4.4	0
m098	0.09	0	0.08	0
m099	2.26	0	4.06	0
m100	14.67	0	6.83	0.41
m102	**3.36**	**29.62**	**1.98**	**20.2**
m103	11.02	2.7	23.18	7.62
m104	19.12	15.79	18.04	37.62
m105	**17.56**	**33.13**	**19.47**	**25.46**
m106	4.16	0	8.06	0.01
m107	7.45	0	6.22	0.28
m108	2.85	1.16	5.75	3.17
m109	24.81	0	13.65	0.56
m110	**28.24**	**0**	**22.94**	**1.21**
m111	**5.7**	**0**	**6.76**	**0.01**
m112	26.59	0.03	36.39	35.01
m113	99.69	99.85	98.3	99.96
m114	0.62	1.4	5.02	0.14
m115	32.54	2.7	38.92	4.99
m116	15.99	38.77	12.96	24.57
m117	**99.98**	**99.95**	**99.78**	**100**
m118	32.99	0	40.6	1.06
m119	49.1	15.37	55.49	35.78
m120	58.27	97.57	64.68	66.62
m121	6.38	0	10.33	0
m122	**42.83**	**2.7**	**46.94**	**12.55**
m123	**1.72**	**0**	**1.17**	**0.16**
m124	**0.83**	**0**	**0.26**	**0**
m125	6.57	0	14.73	0.36
m126	**45.49**	**5.53**	**48.6**	**38.11**
m127	**32.17**	**96.26**	**33.27**	**53.92**

**Bold row indicates a Species of Special Concern in California.*

Table 14 (continued).

Species ID	CA	Ballot	CDFW	TNC
m128	22.71	0	13.74	3.1
m129	13.18	49.65	6.28	11.69
m130	4.37	0	2.16	0.73
m131	**0.99**	**0**	**2.73**	**0**
m132	**6.26**	**40.65**	**4.25**	**9.67**
m133	17.4	0	15.06	3.1
m134	**51.19**	**99.85**	**67.49**	**85.67**
m135	0.75	0	2.26	0
m136	30.58	0	16.59	8.08
m137	8.45	0	3.36	1.12
m138	5.52	0	6.19	0
m139	23.26	16.79	34.23	33.55
m140	23.72	11.54	39.38	52.89
m141	19.09	61.99	24.05	23.25
m142	99.46	99.85	98.3	89.26
m143	22.15	0	8.16	3.53
m144	**3.18**	**15.01**	**3.17**	**9.7**
m145	48.24	59.24	41.17	49.53
m146	99.46	99.85	98.3	89.26
m147	15.59	1.48	16.83	20.6
m148	34.36	2.51	27.4	15.27
m149	94.87	99.85	92.7	99.98
m150	0.22	0	0	10.69
m151	38.53	57.59	22.23	24.02
m152	85.34	99.85	82.66	86.31
m153	75.38	99.85	86.27	99.75
m154	**20.52**	**0**	**6.96**	**2.64**
m155	**24.95**	**28.57**	**8.7**	**11.62**
m156	25.62	37.7	8.35	11.82
m157	75.06	99.85	85.02	99.39
m158	41.4	59.01	42.85	49.33
m159	13.16	0	4.43	1.76
m160	**99.22**	**99.85**	**97.43**	**99.98**

**Bold row indicates a Species of Special Concern in California.*

Table 14 (continued).

Species ID	CA	Ballot	CDFW	TNC
m161	**81.8**	**99.85**	**87.96**	**99.4**
m162	74.95	99.85	86.19	99.58
m163	**25.38**	**31.89**	**30.68**	**41.82**
m164	0	0	0.14	0
m165	**66.42**	**99.8**	**67.69**	**70.46**
m166	99.46	99.85	98.3	89.26
m167	0.07	0	0.2	0
m168	0.23	0	0.19	10.72
m169	0.02	0	0.2	0
m170	0.53	0.1	1.7	10.73
m171	0.53	0.1	1.7	10.73
m173	0.24	0	0.22	10.72
m174	2.7	0	0.47	0
m175	5.56	0	1.01	0.21
m176	19.49	95.15	23.51	65.42
m177	13.8	1.64	13.98	15.21
m178	0.29	4.25	0.01	0.38
m179	0.12	0	0.01	0.33
m180	0.06	0	0	0.05
m181	68.93	99.8	74.52	79.3
m182	6.9	0	8.65	0
m183	33.32	0	34.82	2.6
m184	0.12	0	0.01	0.33
m185	0.12	0	0.01	0.33
m186	0.05	0	0	0
m233	**18.28**	**3.51**	**25.38**	**14.34**
m234	9.42	2.7	25.64	4.42
r002	**0.05**	**0**	**0**	**0**
r003	0.88	1.51	2.39	2.54
r004	**52.98**	**99.85**	**62.39**	**86.1**
r005	21.45	0	12.24	0.61
r006	0.74	0	0.45	0
r007	0.4	0	1.3	0

**Bold row indicates a Species of Special Concern in California.*

Table 14 (continued).

Species ID	CA	Ballot	CDFW	TNC
r008	28.19	1.58	23.77	3.31
r009	0.67	0	12.89	0
r010	24.18	0	25.21	0.77
r011	22.77	0	23.5	0.4
r012	25.79	0	26.24	1.05
r013	**1.83**	**0**	**1.02**	**0**
r014	0.4	0	1.85	0.2
r015	**8.02**	**0**	**7.32**	**0**
r017	24.31	0	15.11	0.61
r018	32.69	0	36.36	4.18
r019	4.8	0	10.4	0.49
r020	7.66	0	16.51	0.57
r021	3.4	0.51	19.24	1.79
r022	69.99	99.85	77.34	98.88
r023	41.42	48.14	25.63	16.92
r024	54.39	5.07	57.32	38.3
r025	16.14	0	22.98	0.45
r026	0.68	0	0.25	0
r027	0.72	0	2.13	0.08
r028	1.02	0	13.41	0
r029	**23.35**	**33.82**	**34.96**	**38.41**
r030	27.64	0	31.78	1.05
r031	2.83	0	2.72	1.42
r032	**2.02**	**0**	**1.53**	**0.36**
r033	2.78	1.57	18.3	0.8
r034	**25.77**	**0**	**29.96**	**8.02**
r035	0.05	0	0	0
r036	**52.31**	**99.76**	**65.03**	**62.74**
r037	26.49	3.47	21.84	41.93
r038	**2.94**	**2.7**	**7.08**	**3.24**
r039	62.36	17.82	69.62	56.82
r040	47.81	99.81	57.74	85.55
r041	**1.37**	**0**	**0**	**0**

**Bold row indicates a Species of Special Concern in California.*

Table 14 (continued).

Species ID	CA	Ballot	CDFW	TNC
r042	30.57	85.39	15.88	18.06
r043	**19.62**	**5.55**	**19.53**	**37.75**
r044	**1.11**	**0**	**0.02**	**0**
r045	33.65	2.7	34.93	4.99
r046	34.73	82.13	16.87	28.32
r047	0.18	0.36	1.45	0
r048	44.15	99.81	53.41	61.96
r049	28.63	95.57	23.07	61.29
r050	23.52	0	25.52	0.81
r051	56.87	99.85	62.54	95.31
r052	**41.37**	**4.37**	**44.91**	**32.05**
r053	34.23	60.69	33.57	56.92
r054	15.06	0	11.55	1.62
r055	**35.68**	**2.19**	**43.08**	**6.56**
r056	33.61	4.15	41.24	20.59
r057	**96.07**	**99.85**	**97.25**	**99.98**
r058	83.58	99.85	86.08	87.59
r059	**27.47**	**34.6**	**11.8**	**14.21**
r060	42.72	4.26	50.68	32.3
r061	**65.54**	**98.5**	**64.42**	**87.57**
r062	48.07	97.07	41.08	62.26
r063	17.71	0	14.06	32.46
r064	0.3	0	0.72	0
r065	0.5	0	0.25	0
r066	25.45	0	25.27	0.77
r067	24.94	0	25.21	0.77
r068	14.77	4.72	29.76	27.81
r069	5.64	0	0.4	7.41
r070	10.03	0	7.38	0.21
r071	27.1	0	16.48	3.97
r072	6.89	0	3.49	0.36
r073	**4.02**	**2.7**	**19.59**	**3.48**
r074	16.39	2.22	28.42	3.79

**Bold row indicates a Species of Special Concern in California.*

Table 14 (continued).

Species ID	CA	Ballot	CDFW	TNC
r075	23.97	0	25.19	0.77
r076	72.68	99.85	84.94	88.7
r077	12.82	0	10.27	0
r078	20.39	96.98	15.52	37.86
r079	6.95	0.09	12.42	13.11
r080	**14.77**	**3.51**	**26.15**	**9.31**
r093	2.84	0	16.24	0.41
r094	**0.01**	**0**	**0**	**0**
r095	0.41	0	0.07	0.03
r100	12.62	0	3.41	0.21
r101	5.03	47.79	3.26	9.65
r102	12.47	0.51	21.49	1.37
r105	25.94	2.34	31.57	4.12
r106	28.88	52.34	42.73	54.39
r107	22.53	0	11.96	0.69
r108	0.54	0	3.15	0

**Bold row indicates a Species of Special Concern in California.*

VITA

Chad M. Stachowiak was born in Baltimore, Maryland and grew up in Baltimore County, Maryland for most of his formative years. In 2005, he graduated from Amherst County High School in Virginia. He graduated *summa cum laude* with a Bachelors of Science degree in Wildlife Science from Virginia Polytechnic Institute and State University (Virginia Tech) in 2011. After graduation he worked on numerous research projects as a research technician that took him to numerous states like Texas, California, Wyoming, Alabama, New Hampshire, and even across the globe to Australia. In August 2015, he entered the Graduate School and the University of Tennessee, Knoxville and joined the Armsworth lab.