DRAFT SAN BRUNO MOUNTAIN HABITAT CONSERVATION PLAN

YEAR 2012 ACTIVITIES REPORT FOR SPECIAL-STATUS SPECIES

Endangered Species Permit PRT-2-9818

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SUMMARY

This report describes monitoring activities and the status of species covered under the San Bruno Mountain Habitat Conservation Plan. This report is prepared on an annual basis and is prepared for the County of San Mateo for submission to the U.S. Fish and Wildlife Service. Three endangered species of butterfly are found on San Bruno Mountain and covered under the San Bruno Mountain HCP: the mission blue, callippe silverspot, and San Bruno elfin butterflies.

In 2012, callippe silverspot butterflies (CS) were monitored on fixed transects. Transects were surveyed for CS three times during the peak of the flight season in May and June. In 2012, Callippes were observed on 12 of the 13 transects and a total of 294 CS were counted. The total average sightings/hour (S/H) for all transects combined in 2012 is 22.7, which is higher than average compared to previous years.

Transects 4 and 10 both had record high sightings per hour. Nearly all transects had both average and maximum S/H higher than that calculated in 2010. Only two transects had a lower S/H: transect 1 and transect 11. Transect 11 was impacted by a wildfire that impacted CS numbers for the second and third monitoring effort, hence the lower S/H for the year. Transect 1 (Dairy Ravine) supports little CS habitat and has consistently had few CS observations during transect monitoring. A decline in habitat quality has been observed on some transects, most typically associated with an increase in scrub. Scrub has increased on transects 6 (water tower) and 8 (quarry), and both scrub and non-native velvet grass (*Holcus lanatus*) has increased on transect 2(Saddle). Transect 3 (Northeast Ridge) has also been partially modified with a result in habitat loss due to the Toll Brothers development. However, CS were seen on transect 3 outside of areas impacted by the development and the average and maximum S/H on this transect was the highest calculated since 2005.

Presence surveys were conducted across the mountain for CS and mission blue butterflies (MB). A 250-meter grid system was used to create individual cells on the mountain with the objective to determine presence of CS and MB in each cell where suitable habitat exists. Prior to the presence survey, MB were already known to occupy 58 cells. Presence surveys documented MB in 23 additional cells scattered around the mountain, but with a concentration on the southeast ridge and south slope. Callippe silverspot butterflies were known to occupy 52 cells, and presence was found in an additional 13 cells in 2012. New occupancy for CS was found primarily on the south slope, with a cluster of cells found to be occupied by CS along a ridge line above Mills Montessori School in South San Francisco.

In early 2013, The San Bruno Mountain Technical Advisory Committee (TAC), West Coast Wildlands (invasive plant control contractor on SBM), and TRA shall discuss where weed management should be focused with respect to CS and MB distribution. Meanwhile, continued control of herbaceous weeds in areas under active weed management is recommended. Data on butterfly and weed distribution will be used by the TAC for developing adaptive management strategies. Transect modification, including potentially adding new transects and abandoning old transects, will also be discussed and decided on with the TAC in early 2013.

I. INTRODUCTION

This report describes the status of listed species and monitoring of these species that took place on San Bruno Mountain under Endangered Species Act Section 10(a)(1)(B) Permit PRT 2-9818 for the 2012 calendar year. Listed butterfly species on San Bruno Mountain include the mission blue (*Icaricia icarioides missionensis,* MB), callippe silverspot (*Speyeria callippe callippe*, CS) and San Bruno elfin (*Callophrys mossii bayensis,* SBE) butterflies.

Special-status species that are monitored on San Bruno Mountain include the three listed butterflies San Bruno Mountain also supports special-status plants, however plant monitoring is not included in the current monitoring program due to funding constraints and the fact that no special-status plant species were taken by development allowed under the HCP. Each butterfly species is typically monitored every other year, which allows for a greater proportion of funding resources to be allocated to control of exotic vegetation in butterfly grassland habitat. In 2012, callippe silverspot were monitored.

San Bruno elfin was last monitored in 2010, and this species was to be monitored in 2012. However, under approval by the U.S. Fish and Wildlife Service and the San Bruno Mountain Technical Advisory Committee, funds for SBE monitoring were reallocated to conduct presence/absence surveys for MB and CS. This is described in greater detail in Section III, below.

Anyone interested in accessing raw data or other information collected by TRA Environmental Sciences should contact Sam Herzberg, Park Planner with the San Mateo County Parks and Recreation Division at (650) 363-1823. Previous annual activities reports are available on-line at: http://www.traenviro.com/sanbruno.

II. STATUS OF SPECIES OF CONCERN

A. Mission Blue Butterfly (*Icaricia icarioides missionensis*)

The mission blue butterfly is the most widespread of the endangered butterfly species on the Mountain, and its distribution corresponds closely to where its host plants and nectar plants are concentrated. The host plants for the mission blue butterfly are three perennial lupines: silver lupine (*Lupinus albifrons* var. *collinus*), summer lupine *(L. formosus* var. *formosus)*, and varied lupine (*L. variicolor*). Mission blues use a variety of native and nonnative species for nectaring (especially thistles), which are found throughout the grassland and coastal scrub plant communities. Protection from wind appears to be an important habitat component for MB, and often the species is detected on the leeward side of slopes, or within protected roadcut areas where host plants are present in suitable densities. Mission blues have been found to move up to approximately 0.25 miles between habitat patches (Thomas Reid Associates, 1982), though the species is likely to move further when dispersing between habitat areas. It is unlikely that MB are capable of immigrating to, or emigrating from, San Bruno Mountain due to the urbanization barriers surrounding the Mountain.

Mission blues utilize silver lupine and summer lupine as their primary host plants, and utilize varied lupine less frequently on San Bruno Mountain. Silver lupine is the most widespread host plant species on the Mountain, and grows within dry habitats such as south and east-facing native and non-native grasslands, roadcuts, rock outcrops, fire breaks, ridgelines, erosion rills, and landslide scars. Summer lupine also grows within disturbed soil conditions, and colonizes roadways and

landslide scars in more mesic areas, where soils are typically deeper and/or more sandy. Varied lupine grows in grasslands and along disturbed roadsides, typically within mesic exposures, and is commonly found within north and west facing grasslands. Mission blues tend to utilize larger patches of varied lupines, or when smaller patches of varied lupine are found in proximity to silver and/or summer lupine.

Typically, MB butterflies begin adult flight in March, and are most abundant in April. Observations begin to drop off by late May or early June. The timing and duration of the flight season is also influenced by overall seasonal climate as well as microclimate within separate regions of the Mountain. Late spring rains can delay the onset of the flight season throughout the Mountain while hot spring conditions can shorten it. Mission blues on the warmer, dryer south-facing slopes of the Mountain begin and end their flight season earlier than colonies on the cooler north-facing slopes.

Transect monitoring of Mission blue butterflies was not conducted in 2012. Data and analysis of the 2011 MB transect monitoring data are available in the 2011 Activities Report for Covered Species (TRA 2012). Mission blue transect monitoring will be conducted in the spring of 2013.

B. Callippe Silverspot Butterfly (*Speyeria callippe callippe*)

The callippe silverspot distribution is similar to that of the mission blue, however CS is less frequently observed on the west side of the Mountain. Habitat for CS includes grasslands supporting its host plant, *Viola pedunculata*. Viola is predominately found within mesic to dry open grasslands on both north and south-facing slopes. Viola can also be found on disturbed roadcuts, and along the boundaries between grassland and scrub under partial shade of taller plants. Callippe silverspots use a variety of native and nonnative species for nectaring (especially thistles) that are found throughout the grassland and coastal scrub plant communities.

Ridgelines and hilltops within grassland habitats are an important habitat component for this butterfly species, as CS utilize these features for mate selection. The species has been shown to move up to approximately 0.75 mile between habitat patches (Thomas Reid Associates, 1982), but likely can move further in multiple movements.

The flight season for adult CS is typically from mid-May to mid-July. Due to their larger size and stronger flying ability than mission blues, CS are not as sensitive to strong winds. Often this species is detected along ridgelines and hilltops in high densities, sometimes during windy conditions (>10 mph average).

Transect monitoring of Callippes was conducted in the spring and summer of 2012. Survey methodology and results follow.

Methodology

Surveys were conducted on fixed transects to provide a means with which to compare CS observations from year to year at specific locations. Fixed transect locations were not chosen randomly but were placed in habitat areas with higher butterfly densities and areas that include a variety of slope exposures, nectar plants, and soil conditions (i.e. road cuts, ravines, and natural slopes). Even within high-density habitat locations, it is sometimes difficult to observe enough butterflies for statistical comparison. For this reason, fixed transects have been located only in areas

where there is a good chance of observing CS under desirable weather conditions. Transects vary in length from approximately 500 to 2100 meters and are permanently marked in the field (Figure 1). A total of 13 fixed transects were monitored in 2012.

Twelve of the 13 transects have been surveyed for CS since 2000. Transect 13, east of the terminus of Carter Street and on the north side of Guadalupe Canyon Parkway, was added in 2005. This location was chosen in order to learn more about potential CS presence and movement in grasslands north of Guadalupe Canyon Parkway.

Ideally, each transect is monitored approximately 3 times during the peak of the flight season, with monitoring at any individual transect spaced at least 2 weeks apart. Prior to 2010, transects were visited more often, capturing both the start and the end of the flight season when CS abundance was low. Monitoring occurs only during warm, calm weather (wind speeds less than 10 miles per hour) when CS are most active. Efforts are made to complete an observation cycle (a survey of all thirteen transects) within two days. All butterflies observed beyond a transect or in the transect vicinity during travel between transects are recorded as incidental observations. It should be noted that because of the steep slopes, various microclimates, and limited survey days, it is a challenge to monitor the butterflies on San Bruno Mountain in a consistent manner from year to year.

The duration spent walking a transect is recorded by the observer, and all CS observed along the transect are noted. The location and time of the observation is recorded on a map. The number of CS sightings per hour (S/H) is used for analysis. The number of CS observed on a particular transect is divided by the number of minutes to complete the transect survey. For each year, the average and maximum CS sightings per hour for all transects are used to look for upward or downward trends in CS encounter rates among and within transects. The maximum value is the highest S/H recorded on a transect in a given year. The maximum S/H found on a transect in a given year is a useful variable for analysis. By looking at only the maximum S/H, those S/H measurements captured at the beginning or end of the peak flight season that may be of lower value do not skew the data.

Results

The summer of 2012 was warm and mild, and transect surveys were successfully scheduled during the peak of the flight season with all transects surveyed over two subsequent days for three survey bouts. Surveys were conducted on May 30-31, June 11-12 and June 26-27. A total of 294 CS were counted, which is slightly more than was counted in 2010 (the last time CS were surveyed), when 260 CS were observed. In 2012 and 2010, transects were monitored 3 times each, centered around the peak of the flight season.

Figure 1 (all figures are located after Section V) illustrates where transects are located and where CS were recorded during 2012 transect monitoring. Callippes were observed on 12 of the 13 transects. The total average sightings/hour (S/H) for all transects combined in 2012 is 22.7, which is significantly higher than the 2010 S/H of 16.2 or than the average S/H for the prior eight years of monitoring (14.6). Figure 2 illustrates average annual S/H on all transects combined since 2000. The average and maximum S/H for each transect in 2012 is displayed in Figures 3 and 4.

Tables 1 and 2 below show the average and maximum S/H on each individual transect from 2000 to 2012. This is provided visually in Figures 5-16 and is discussed in detail below.

Table 1. Average S/H on each Transect from 2000 to 2012

Year/ Transect	2000	2001	2002	2003	2004	2005	2006	2008	2010	2012
1	2.3	4.2	2.5	1.4	1.2	1.6	0	4.4	2.0	0
2	3.2	5.0	10.2	3.2	1.7	2.4	3.0	0.5	1.0	1.8
3	16.5	21.4	31.1	32.1	23.4	23.1	12.1	14.5	3.6	23.3
4	12.3	26.1	16.1	7.7	11.5	5.5	3.5	11.2	13.6	32.7
5	5.2	28.7	23.9	10.0	16.7	26.2	14.7	16.9	7.7	17.8
6	1.1	1.4	9.1	6.9	0.8	4.2	1.4	2.2	0	1.3
7	20.4	25.1	9.8	10.9	13.0	16.6	25.4	30.5	20.2	18.1
8	18.6	10.5	17.2	7.6	5.9	11.4	4.8	12.5	3.3	5.0
9	5.2	24.5	16.2	1.6	5.5	19	13.7	55.6	14.6	22.5
10	11.5	37.6	13.7	5.7	6.2	21	15.1	23.0	28.6	68.1
11	25.4	79.0	14.4	18.4	8.2	37.6	37.4	35.6	38.6	23.7
12	14.2	20.1	2.0	6.8	11.4	18.9	34.2	17.2	23.9	26.7
13	N/A	N/A	N/A	N/A	N/A	5.2	0	0	0	3.3

Table 2. Maximum S/H on each Transect from 2000 to 2012

Year/ Transect	2000	2001	2002	2003	2004	2005	2006	2008	2010	2012
1	4.6	12.4	7.2	8.6	2.9	6	0	10	2	0
2	6	13.5	19.4	7.2	3	5.5	9.6	2	1.8	7.5
3	34.3	54.3	48.5	50.3	42.2	45.6	31.3	42.5	10.6	70
4	20.5	58.5	38.7	20	30	18.3	2.9	27.7	23.6	65.7
5	10.3	53.6	56.5	24	31.7	62.5	50.4	57.6	11.1	30
6	3.3	4.2	16.8	16.7	2.2	16	4.1	4.3	0	5.5
7	47.1	51.3	20.5	20.8	28.9	24	69.5	45.8	17.1	34
8	43.6	23.6	30	25	15	35	5.5	21.8	7.5	10
9	9.6	60	25.2	4.7	33.6	43.5	42.4	77.4	24	34
10	23	45	25.7	17.4	24.3	47.6	19.4	42.9	39.3	86
11	38.4	131.1	20	34.3	18.9	77.1	132.9	63.2	62.3	49
12	28.3	33.2	6	27.4	20.9	60	88.4	34.1	35.3	66.7
13	N/A	N/A	N/A	N/A	N/A	15.0	0	0	0	6.7

Since 2000, Transect 1 (Dairy Ravine) has consistently had a low sightings/hour due to the limited viola habitat along this transect. In 2012, no CS were seen on transect 1. In 2010, transect 1 was monitored three times, and a single CS was observed during each survey. Figure 5 shows the annual S/H for this transect since 2000. Transect 1 supports primarily coastal scrub, and areas of grassland habitat supporting viola are limited. No notable changes or threats to the grassland habitat were noted along transect 1 in 2012. Callippes are likely still using the limited habitat located along this

transect, but may not be present here every year, or may not be detected in a given year due to their low abundance.

On transect 2, one CS was observed during two of the three transect surveys in 2012. The maximum and average S/H on transect 2 are 7.5 and 1.8 respectively. This is similar to the S/H calculated in previous years (Figure 6). Like transect 1, there is only limited viola habitat along this transect. As described in the 2010 annual report, an observable change in vegetation has occurred, with an increase in scrub and velvet grass having replaced some grassland. The midpoint of the transect has become very difficult to traverse due to the increase in scrub. Habitat for CS is located primarily at either end of the transect, north of the Saddle Loop Trail, and on the slope above Carter Street.

Transect 3 is located on the Northeast Ridge and includes Callippe Hill and a portion of land owned by Toll Brothers Development (Figure 1). Data for transect 3 were surprising this year. During the first survey effort in late May, 14 CS were observed over the course of a 12 minute walk from the south toe of slope up to Callippe Hill. Then no CS were seen on either of the following two surveys in June. Transect 3 used to head west from Callippe Hill and terminate across from Carter Street (Figure 1). However, as the western end of this transect is now fenced off and was under active grading during the time of the surveys, the transect was modified to end at the fence (new west transect terminus marked in Figure 1). As Callippes were observed during one of three surveys, the transect's maximum and average S/H vary substantially from one another, with a maximum S/H of 70.0 obtained during the May survey, and an average S/H of 23.3 (Figure 7).

Transect 4 is located on the north side of Guadalupe Canyon Parkway, and across from the Northeast Ridge and Callippe Hill (Figure 1). Callippes were very abundant on transect 4 in 2012, with a record high maximum S/H of 65.7 and average S/H of 32.7 (Figure 8). Callippes were most commonly observed along the west side of the transect, on the grassy slope north of Guadalupe Canyon Parkway (Figure 1). Several CS were also observed at the east end of the transect, along the cut slope adjacent to the parkway.

The average and maximum S/H on transect 5 (17.8 and 30 respectively), located on the eastern side of the Northeast Ridge (Figure 1), was higher than reported in 2010 and similar to what has been calculated since 2000 (Figure 9). Little change in habitat quantity or quality has been observed along this transect, and CS continues to be recorded here in similar abundance.

Transect 6 intersects little viola habitat, and few CS are recorded here. In 2012, only 1 CS was observed during the May survey. In 2010, no CS were seen during any of the surveys. The northern portion of the transect has become so dense with scrub that the last part of the transect is no longer passable. Thus, the transect was shortened, as shown in Figure 1. Scrub includes coyote brush, poison oak, Scotch broom, and gorse. Meanwhile, Italian thistle has proliferated along the east-west portion of the transect. Only a few CS have been seen in transect 6 in past years, and the S/H has typically ranged between 2.0 and 6.0.

Transect 7 is located along the Ridge Trail (Figure 1). No change in habitat here was identified, and the average S/H in 2012 did not differ noticeably from that recorded in previous years (Figure 11).

Transect 8 is located east of the quarry (Figure 1), and access is made through the quarry property. The scrub and particularly poison oak along this transect has increased significantly over the years, and the upper portion of the transect is no longer passable. Therefore, as with transect 6, this transect

was shortened in 2012 as shown in Figure 1. One CS was seen on transect 8 in 2012, for an average and maximum S/H of 5 and 10 (Figure 12). There has been a slight downward trend for both average and maximum S/H on transect 8 since 2000, and this is likely due to the conversion of grassland habitat to scrub.

Transect 9 follows a ridgeline between Owl and Buckeye Canyons down from the Ridge Trail (Figure 1), and much of this transect was burned in a fire that occurred in the summer of 2008. Viola and nectar plants have regenerated along this transect, and the average and maximum S/H calculated is up from 2010 (Figure 13). Overall, the S/H calculated along this transect has shown annual variation, with no noticeable upward or downward trend since 2000.

Transect 10 is located east of Buckeye Canyon and follows an existing, gravel, P&E road (Figure 1). The maximum and average S/H on this transect in 2012 were 86 and 68.1 respectively, which is the highest ever observed on this transect (Figure 14). During the May survey, 40 CS were counted over 28 minutes, and 34 were counted over 26 minutes during the first June survey. Prior to this year, the S/H on this transect had remained fairly static since 2000 (Figure 14).

Transect 11 follows the eastern portion of the Southeast Ridge (Figure 1) and has always been a higher performing transect as it follows hill-topping habitat with a variety of nectar plants and adjacent grasslands supporting viola. In 2012, the average and maximum S/H recorded were 23.7 and 49 respectively. Although variation from year to year is observed, there is no detectable upward or downward trend in S/H recorded since 2000.

Transect 12 follows the southeast ridge east and downward to the mountain's base near Bayshore Blvd (Figure 1). The transect also includes part of a subridge north toward the Brisbane Acres. In 2012, a small grass fire burned the steep slope along the southern part of the transect up to where the transect meets up with the Ridge Trail. Data collected in May were prior to the fire and data collected during the surveys in June were post fire. Twenty CS were counted during the May survey. After the fire, 4 CS were seen during the first June survey, and none were seen during the second June survey. As the fire temporarily changed the quality of habitat, the maximum S/H recorded in May is the most useful, and this S/H of 66.7 was the second highest recorded since 2000 (Figure 16).

Transect 13 was established in 2005 to collect data on butterfly presence as it is across from the section of Northeast Ridge that was at that time planned for development (and currently under development). Very few butterflies have ever been recorded on transect 13. During the first year this transect was surveyed (2005), an average S/H of 5.2 and a maximum of 15.0 was recorded. Then in 2006, 2008 and 2010 no CS were seen. This year, a single CS was recorded here, with an average and maximum S/H of 3.3 and 6.7. Transect 13 supports little viola habitat and is in close proximity to Guadalupe Canyon Parkway.

Discussion

Excellent weather for butterfly monitoring occurred during the monitoring period of May and June, 2012, resulting in higher than average S/H on numerous transects. Transects 4 and 10 both had record high sightings per hour. Nearly all transects had both average and maximum S/H higher than that calculated in 2010. Only two transects had a lower S/H: transect 1 and transect 11. Transect 11 was affected by a wildfire that reduced CS numbers for the second and third monitoring bouts, hence the lower S/H for the year.

The average S/H recorded in 2012 across all transects was the second highest recorded since 2000 (Figure 2). In addition, since 2004, the overall S/H has trended upwards. However, in 2012 and 2010, surveys were concentrated around the peak of the flight season whereas in prior years, surveys included the start and end of the flight season (both ends of a bell shaped curve). Therefore, it was expected that a higher S/H would have been observed in these past two monitoring years. Even given year to year variances in abundance and distribution, which is expected, monitoring data indicates that the overall CS population on San Bruno Mountain continues to thrive.

Recommendations

In 2010 annual report, TRA recommended that presence surveys be conducted for CS and MB to obtain data on butterfly distribution within areas not intersected by transects. This was performed in 2012 and is described in Chapter III, below.

It was also recommended in the 2010 report that transects be evaluated for continued monitoring, and that new transects be considered. It was recommended that transect 13 be abandoned as it was originally established in 2005 to provide data on CS distribution and movement with respect to the Brookfield Northeast Ridge development (now Toll Brothers). Transect 13 intersects limited and sparse butterfly habitat. However, transect 13 was included in 2012 as TRA decided to not make any changes to transect monitoring at this time. Instead, data from the presence surveys will help to guide transect modification with input from the SBM Technical Advisory Committee (TAC).

An increase in both scrub and non-native species in the vicinity of transects 3, 6, and 8 have made these transects more difficult to access, and both 6 and 8 were shortened in 2012 as passage was no longer possible. These three transects support only small areas of suitable habitat and few butterflies are found here. Meanwhile, extensive grasslands with host and nectar plants are found on the south slope and are not currently part of the monitoring program. Transect modification, including potentially adding new transects and abandoning old transects, will be discussed and decided on with the TAC in early 2013.

Results of the monitoring will help direct the TAC, West Coast Wildlands (invasive plant control contractor on SBM), and TRA as to which areas of the Mountain weed management should be focused with respect to CS distribution. As stated above, an increase in scrub has been observed on several transects. Meanwhile, continued control of herbaceous weeds in areas under active weed management is desired. Data on butterfly and weed distribution will be used by the TAC for developing adaptive management strategies.

C. San Bruno Elfin (*Callophrys mossii bayensis*)

San Bruno elfin are closely associated with their host plant, Pacific stonecrop (*Sedum spathulifolium*), which grows within higher elevation grasslands on northeast to northwest facing slopes above 500 feet elevation. Sedum often grows along transition areas between scrub and grassland. San Bruno elfins occur where there are high densities of sedum and in areas that are protected from strong winds. San Bruno elfins use a variety of nectar plants limited to the upper elevation grasslands and scrub on the Mountain. This species has been documented to move at least 0.15 mile between habitat patches (Arnold, 1983), and can likely move much further over the course of multiple flight movements.

The adult flight season for SBE typically occurs between early March and mid April. Third and fourth instar SBE larvae are present and easily identifiable on sedum flower heads typically for 2-3 weeks in May and/or June. Monitoring of elfin larvae is performed every other year. However, as stated earlier in this report, 2012 monitoring was not conducted in order to allocate funds to presence/absences surveys for CS and MB.

All existing SBE butterfly habitat on San Bruno Mountain has been protected as open space within San Bruno Mountain State and County Park since 1975. Development that was approved through the San Bruno Mountain HCP did not affect this species, and therefore monitoring and management for this species and its habitat was not a requirement of the HCP permit. However, this species' habitat partly overlaps with that of the mission blue and callippe silverspot, and is composed of some of the most pristine coastal prairie and coastal scrub habitat on the Mountain. Therefore, monitoring and management of SBE has been performed on San Bruno Mountain because of the biological value of this species and its habitat.

San Bruno elfin butterflies were not monitored in 2012. Data and analysis of the 2010 MB monitoring data are available in the 2010 Activities Report for Covered Species (TRA 2011).

D. Bay Checkerspot Butterfly (*Euphydryas editha bayensis*)

A small population of the Bay checkerspot butterfly (BCB) was present near the summit of San Bruno Mountain up until the mid-1980's. This species has not been observed on SBM in over 20 years. No BCB larvae or adults were observed on San Bruno Mountain by field crews while conducting biological activities and overseeing development activities in 2012. In October 2000, the U.S. Fish and Wildlife Service (USFWS) proposed critical habitat for the BCB, followed by a Final Rule issuance on the critical habitat designation in April 2001. The critical habitat designation includes the historic BCB habitat on the main ridge of San Bruno Mountain. This species must be taken into account when planning any activities that could impact BCB habitat.

E. San Francisco Garter Snake (*Thamnophis sirtalis tetrataenia*)

The San Francisco garter snake (SFGS) was identified in the San Bruno Mountain HCP (1982) as having potential habitat on San Bruno Mountain. No SFGS were observed on the Mountain by field crew while conducting biological activities and overseeing development activities in 2012. There have been no confirmed observations of SFGS on San Bruno Mountain in the nearly 30 years of the HCP monitoring program. Based on the lack of significant ponds and other aquatic habitats, this species is unlikely to be present.

F. California Red-legged Frog (*Rana aurora draytonii*)

The California red-legged frog (CRLF) shares similar aquatic habitat with SFGS. Though it was not identified as a sensitive species at the time of the HCP, CRLF has since been listed as a Federally Threatened species. No CRLF were observed on San Bruno Mountain by field crews while conducting biological activities and overseeing development activities in 2012. There have been no confirmed observations of CRLF on San Bruno Mountain in the nearly 30 years of the HCP monitoring program. Based on the lack of significant ponds and other aquatic habitats on San Bruno Mountain, it is unlikely this species is present.

G. Plants of Concern

Several rare and listed plant species are found on San Bruno Mountain, however, no rare plants were monitored with HCP funds in 2012. In previous years, colonies of listed plants or rare plants with a status of CNPS List 1B or higher (i.e. *Arctostaphylos imbricata imbricata*, *Lessingia germanorum*, *Silene verecunda ssp. verecunda*, and *Helianthella castanea*) were mapped using GPS. See previous annual reports (1999-2007) for maps showing the distribution of these rare plants on San Bruno Mountain.

III. 2012 PRESENCE SURVEYS

The current monitoring program for mission blue and callippe silverspot butterflies is restricted to set transects, and there are areas of the mountain not intersected by transects where butterfly presence has not been confirmed in recent times. Since it is desirable to have current data on mountain-wide butterfly distribution and trends in occupancy, resources were re-allocated from San Bruno elfin surveys (which had been scheduled for 2012) to a mountain-wide presence survey for MB and CS. Occupancy data can be used to guide habitat restoration work, weed control efforts, and to assist with transect modifications. Presence surveys were first recommended for San Bruno Mountain in Travis Longcore's *Analysis of Butterfly Survey Data from San Bruno Mountain Habitat Conservation Plan* (Longcore 2003, Appendix A).

Methodology

TRA replicated the 250-meter grid system developed by Longcore (2003) with the objective to determine presence of CS and MB in each cell (Figure 17). Prior to conducting surveys, cells were analyzed for general habitat type. Cells that clearly support only dense coastal scrub, such as some cells on west and north facing slopes, were determined to have no potential to support MB or CS and thus were excluded from the survey. Also excluded were any cells already known to be occupied by each species. These include cells intersected by transect monitoring and within which MB or CS have been observed within the past 5 years. Cells known to support any amount of grassland or open, rocky areas and where CS and MB presence is not known, were included in the survey.

Cells were surveyed for MB between the dates of April 23 and May 1, 2012. Cells were surveyed for CS between the dates of June 7 and June 20, 2012. These dates correspond to the peak of the flight season as found on SBM in past years of transect monitoring. Surveys were conducted on warm calm days to maximize the chance for butterfly encounters. Monitors surveyed each cell on foot, traversing grassland and open areas. As soon as an individual MB or CS was observed, the monitor would mark that cell as present, and move on to the next cell. While in a cell, monitors would note habitat quality, including the presence of invasive weeds.

Longcore (2003) had advised that each cell be visited a minimum of 3 times for each species (6 visits total), at an estimated cost of between $24,450 and $29, 700 (2003 dollars). TRA had a budget of $8,500, and was initially able to visit the cells only once per species. Some funds remained following completion of CS presence surveys, and with the remaining budget, monitors re-surveyed several cells where CS had not been observed, but habitat was suitable.

As most cells were visited once, a finding of absence does not mean that the species is not there, as it simply may have not been detected at the time of the survey. Cells with lower habitat quantity or

quality may have only low butterfly usage of habitat and thus be harder to detect presence. Despite not visiting each cell 3 times per species, presence was found in a number of cells in which presence had not been confirmed in recent years, as described below.

Results

Presence surveys for MB were more time consuming than for CS as there are a greater number of cells supporting lupines and MB are less abundant that CS on San Bruno Mountain and thus harder to detect. Figure 18 presents findings on MB presence. Prior to the presence survey, MB were already known to occupy 58 cells. Presence surveys documented MB in 23 additional cells, as shown in Figure 18.

Some cells were found to support medium to high quality MB habitat (defined as supporting a sizable stand of host plant lupines), however MB were not detected. It is presumable that MB may utilize habitat within these cells, and either simply were not detected during the survey or are not present in these cells all years. These 21 cells have been marked as "suitable habitat present" and are shown in Figure 18.

Callippe silverspot butterflies were known to occupy 52 cells, and presence was found in an additional 13 cells in 2012 (Figure 19). New occupancy information was obtained primarily on the south slope, with a cluster of cells found to be occupied by CS along a ridge line above Mills Montessori School (Figures 19 and 20). Cells were not marked as "suitable habitat present" as was done with MB because the host plant for CS, *Viola pedunculata*, is not visible at the time surveys were conducted. Viola blooms typically in February and dies back in the spring.

Discussion

Mission blue butterflies have a wide distribution on San Bruno Mountain as their host lupine plants can be found not only in grassland habitat but also in open rocky or disturbed areas within coastal scrub. Sometimes host plants are found in small patches and/or have only sparse cover. Therefore it is more challenging to develop a transect monitoring scheme that intersects most of the MB habitat on the mountain, making mountain-wide presence surveys all the more valuable and informative.

Presence surveys found MB in 23 cells for which, until this time, there was no recent presence information. It is likely that MB are using all of the south slope for foraging, and Figure 18 shows all cells in this area labeled as either MB present or suitable habitat present. Within these cells, host plant density varies, with some areas supporting only sparse coverage. MB likely use these areas, but may not be present all years, or at all times during a flight season.

Most cells in which MB presence was found in 2012 are adjacent to cells in which presence was already known. However there are a few outliers, including cells 182, 206, 295 and 298. The two areas with the most significant abundance of host plants and mission blue butterflies are the southeast ridge and south slope and the northeast ridge extending to the eastern saddle. Habitat areas such as that found within cells 182 and 206 provide a flight corridor for MB traveling between these two larger habitat areas. Likewise, patches of habitat in cells 295 and 298, as well as 198 and 199 may facilitate MB movement from the southslope northwest toward habitat located in the vicinity of the ranger's station. Thus although these outlier habitat areas may

support only fragments of MB habitat, they are still important for MB movement and should be considered during weed and scrub management planning.

Callippe host plants are found only in grassland habitat, and CS distribution is more limited than MB. Thus it is not surprising that there were fewer cells where new presence information for CS was collected. Cells where presence was found in 2012 include several cells on the southslope, and a cluster of cells to the west of this, including cells 346, 347, 369-371, and 395. This is an area that supports grassland with abundant host and nectar plants, and hill-topping habitat along the ridgeline. This occupancy information will be used by the TAC in planning for weed management in the next fiscal year.

Recommendations

Transect monitoring excludes portions of San Bruno Mountain that support suitable butterfly habitat, and therefore gathering mountain-wide information on butterfly distribution is a very valuable exercise. It is recommended that presence surveys for MB and CS be repeated every five years, with the next presence survey to be conducted in 1217. If more funds were to be made available, it is desirable to survey each cell 3 times per species during the peak of the flight season, as recommended by Longcore (2003).

Data collected from the 2012 presence survey can be used to guide the placement of newly developed transects for the butterfly transect monitoring program, if new transects are desired as determined by the TAC in consultation with the U.S. Fish and Wildlife Service. Preliminarily, it is recommended that new MB transects be added to capture more of the southslope, such as in the vicinity of cells 350, 351, 326 and 327. For CS, one transect each should be added in the vicinity of cells 404, 405, and 381 as well as 346, 347, 370, 371, and 395.

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All TRA documents/ resources available on-line at http://www.traenviro.com/sanbruno/ *or from County of San Mateo Parks and Recreation Division.*

V. STUDY PARTICIPANTS

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2012 TRA Environmental Sciences Field Crew: Autumn Meisel and Megan Kalyankar.

County Coordinators for San Bruno Habitat Conservation Plan: Sam Herzberg

FIGURES

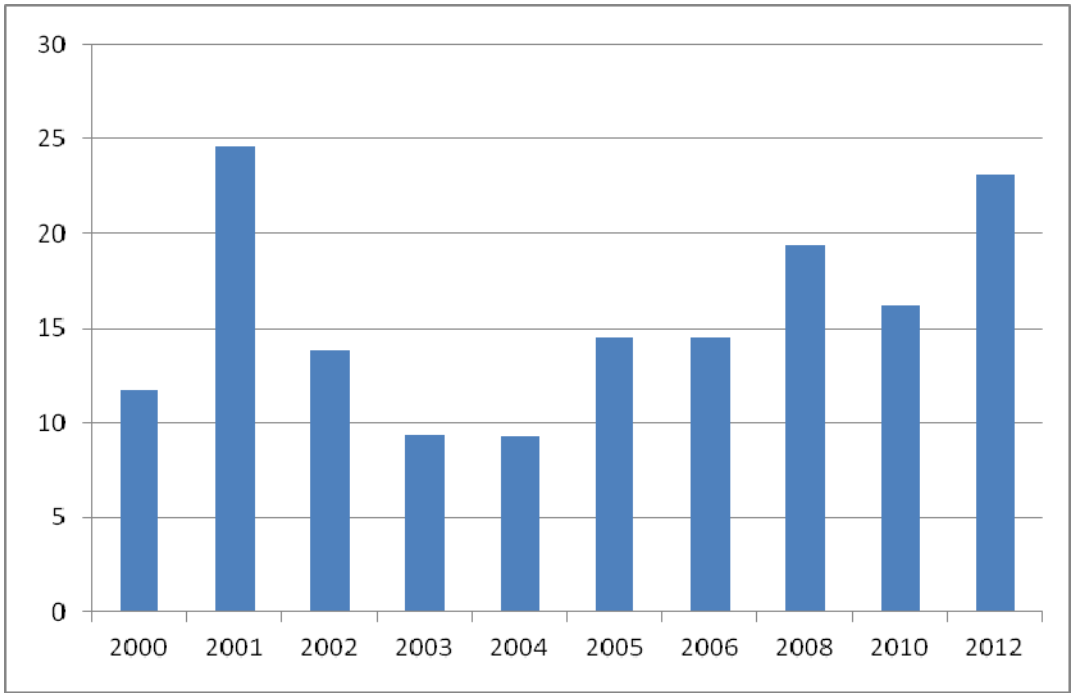


Figure 2. Average CS Sightings/Hour across all transects, 2000- 2012

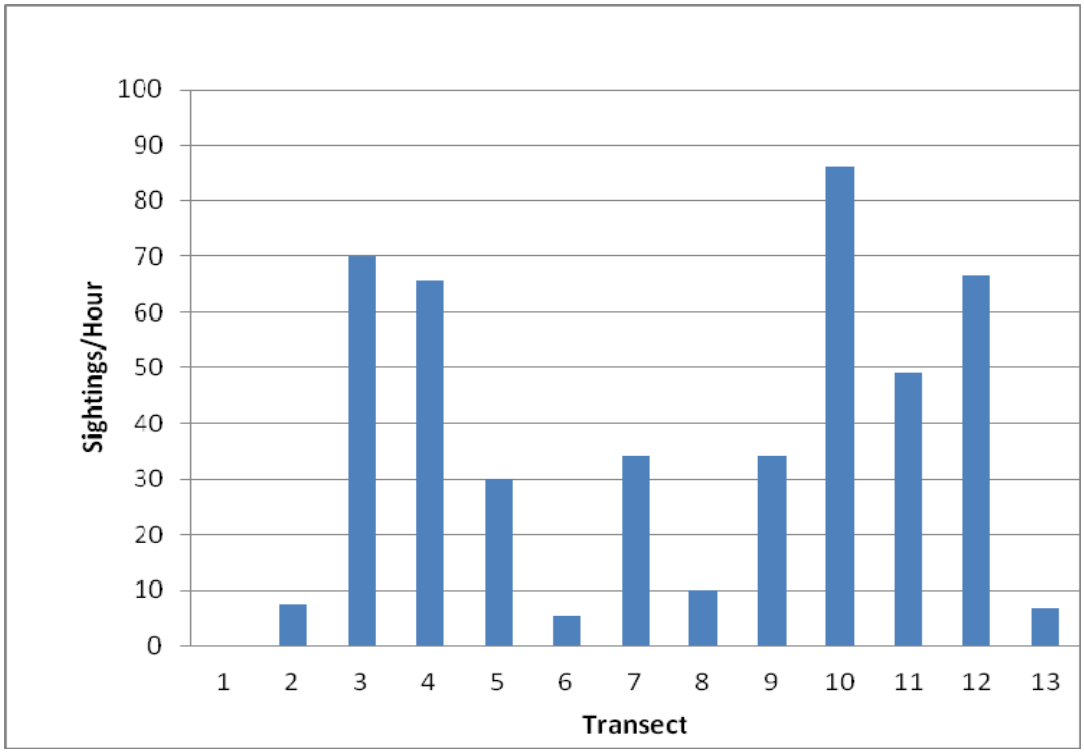


Figure 3. Maximum number of CS sightings per hour for each transect in 2012

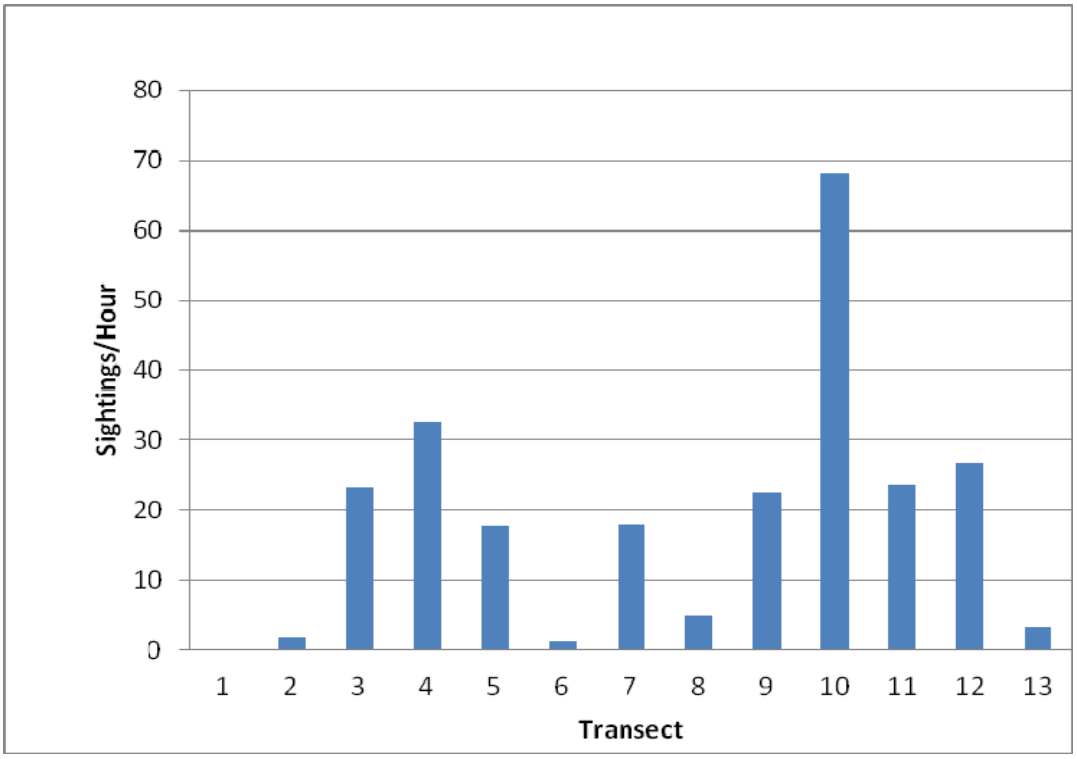


Figure 4. Average number of CS sightings per hour for each transect in 2012

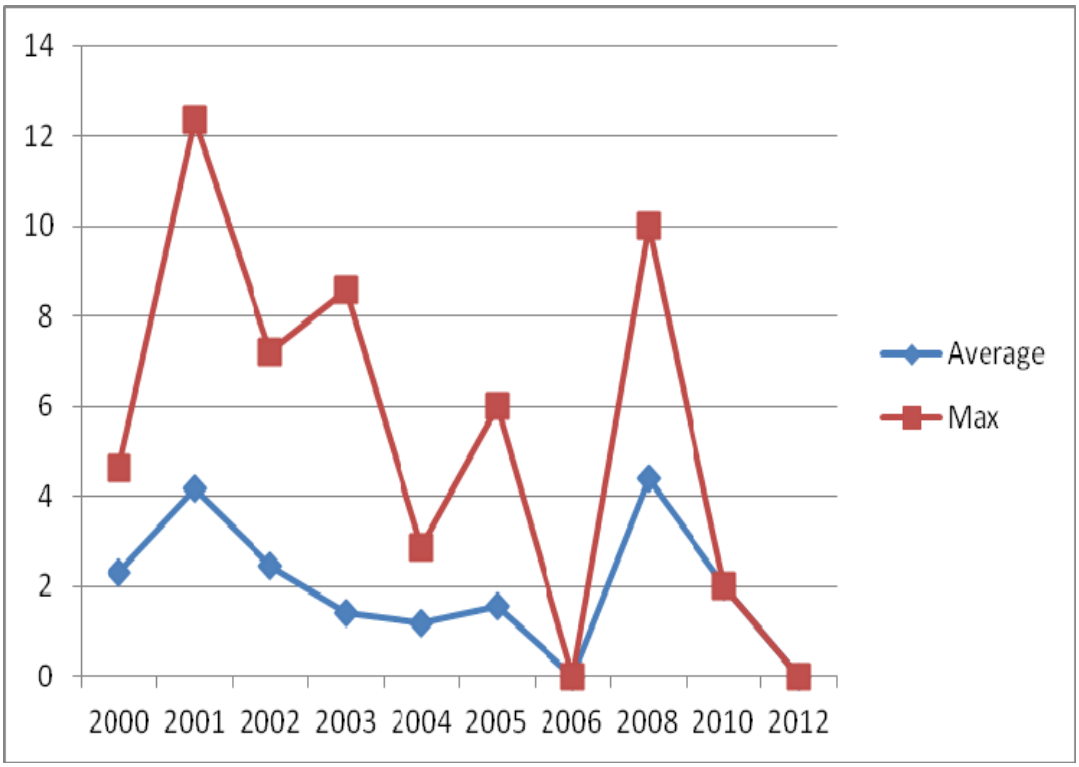


Figure 5. Average and Maximum Sightings/Hour on Transect 1, 2000-2012

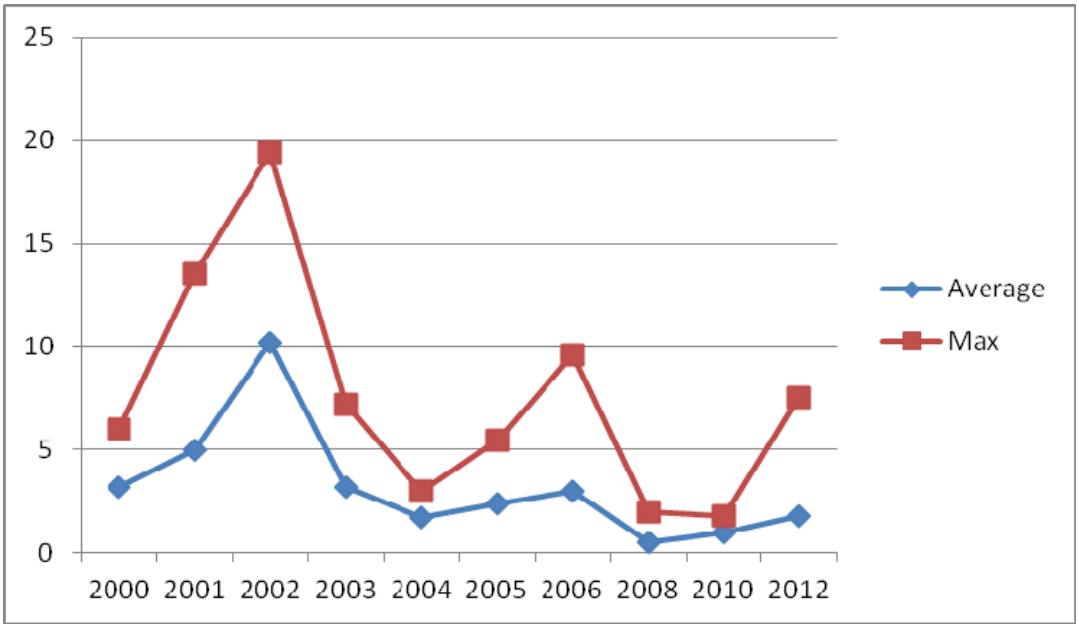


Figure 6. Average and Maximum Sightings/Hour on Transect 2, 2000-2012

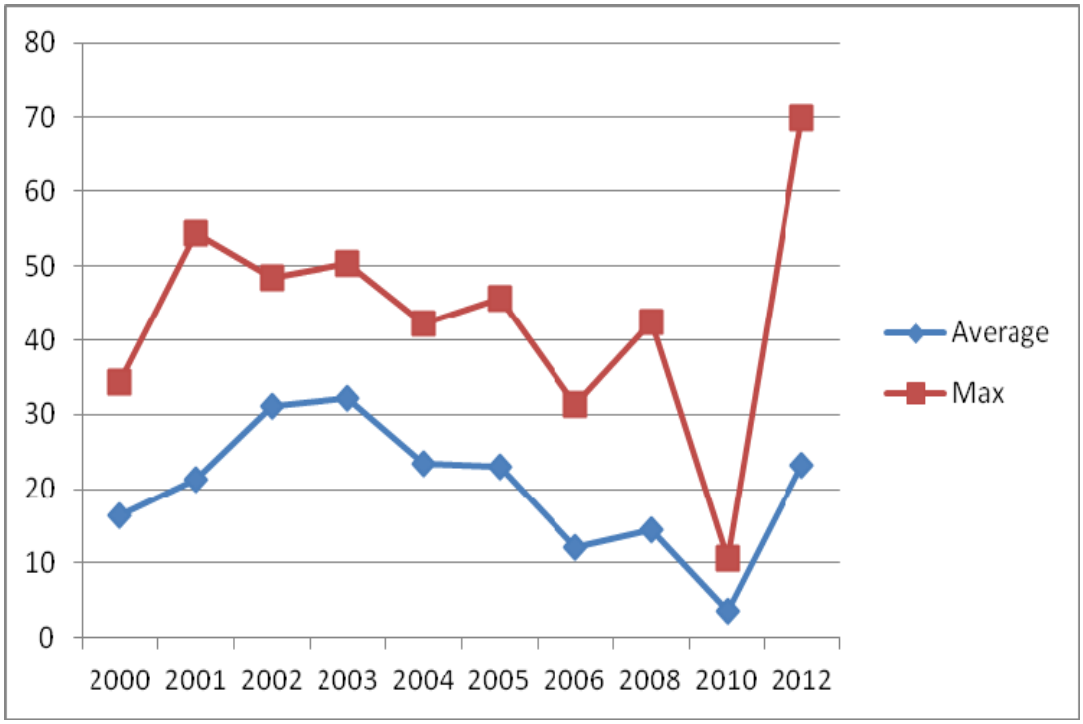


Figure 7. Average and Maximum Sightings/Hour on Transect 3, 2000-2012

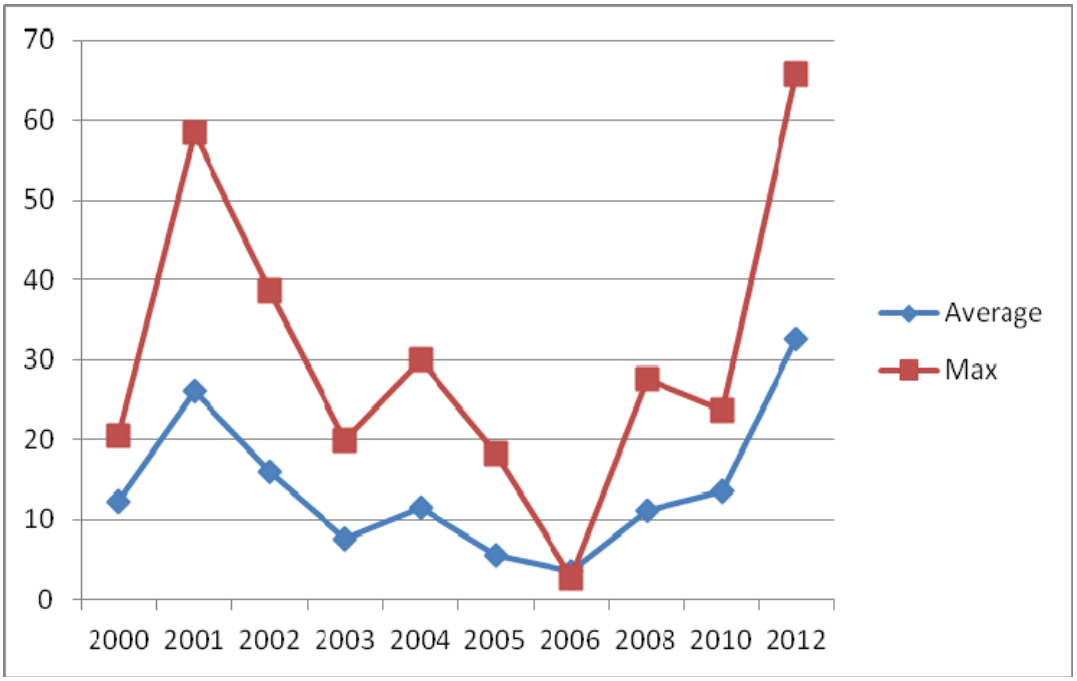
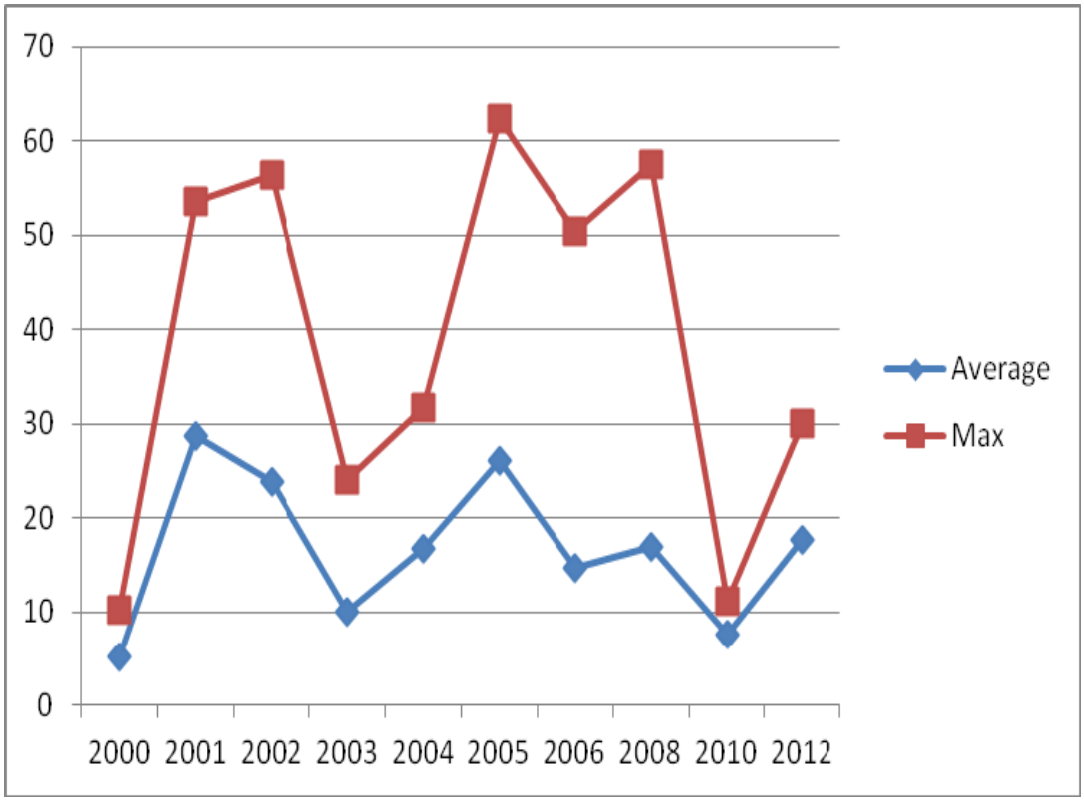


Figure 8. Average and Maximum Sightings/Hour on Transect 4, 2000-2012



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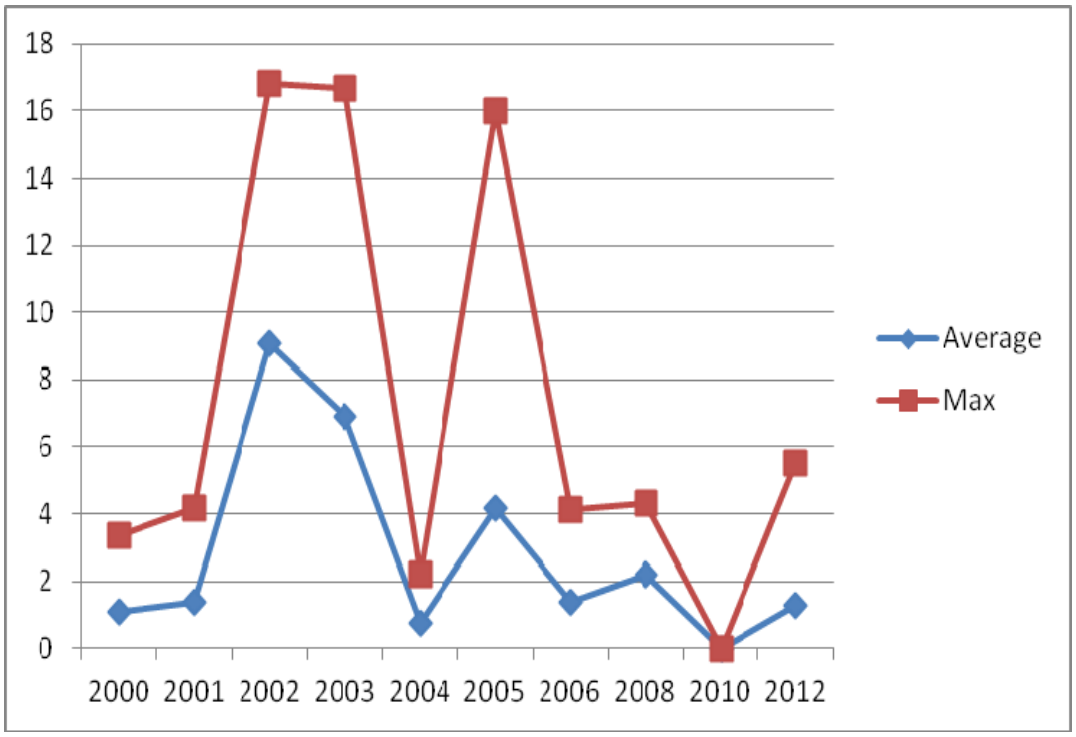

Figure 10. Average and Maximum Sightings/Hour on Transect 6, 2000-2012

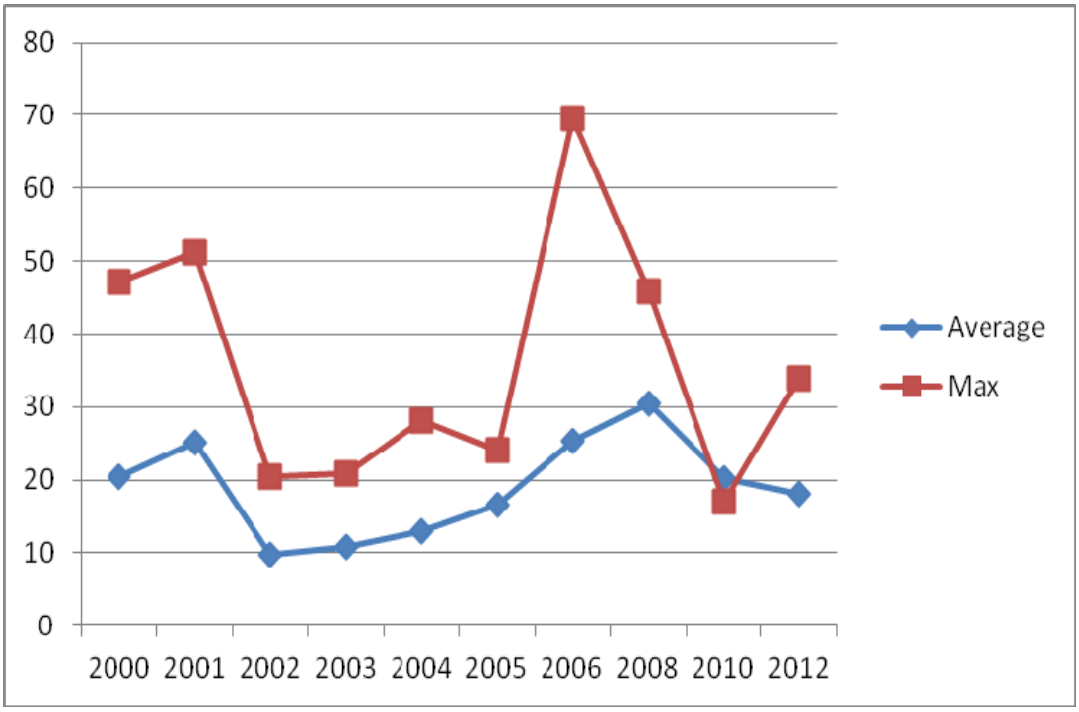

Figure 11. Average and Maximum Sightings/Hour on Transect 7, 2000-2012

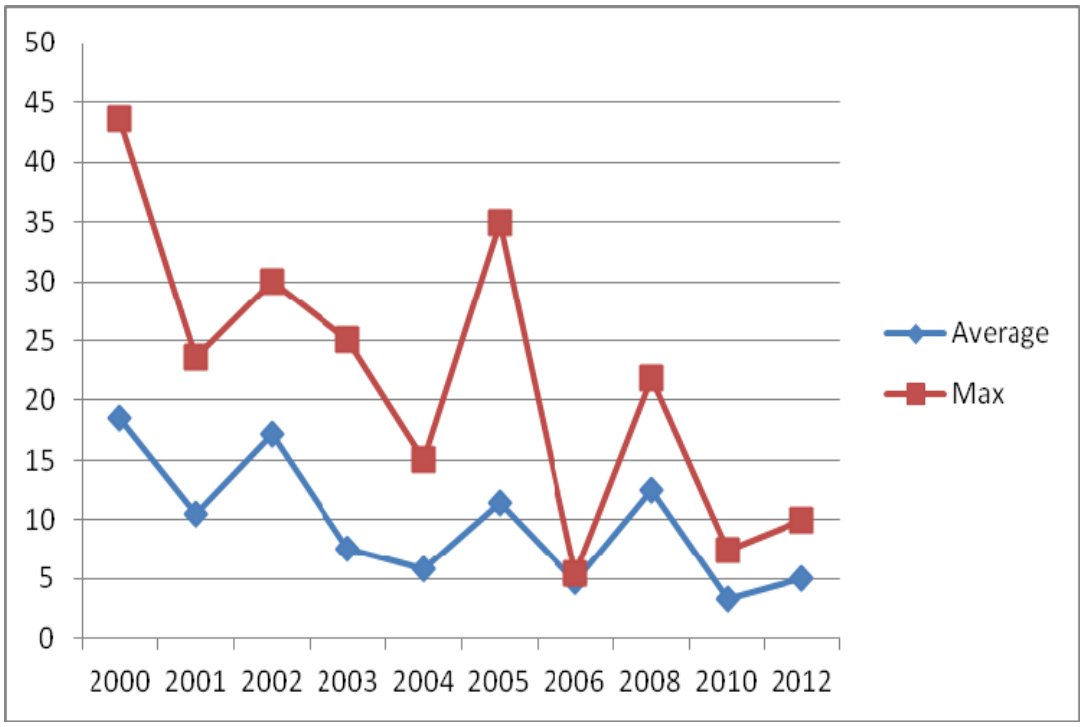

Figure 12. Average and Maximum Sightings/Hour on Transect 8, 2000-2012

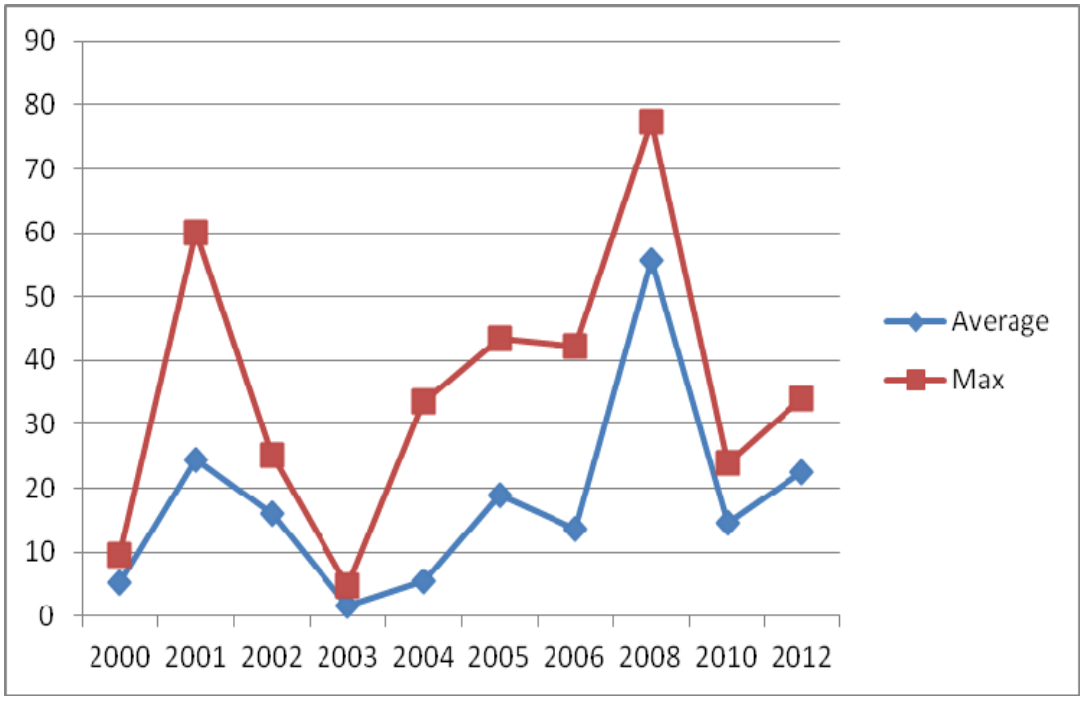

Figure 13. Average and Maximum Sightings/Hour on Transect 9, 2000-2012

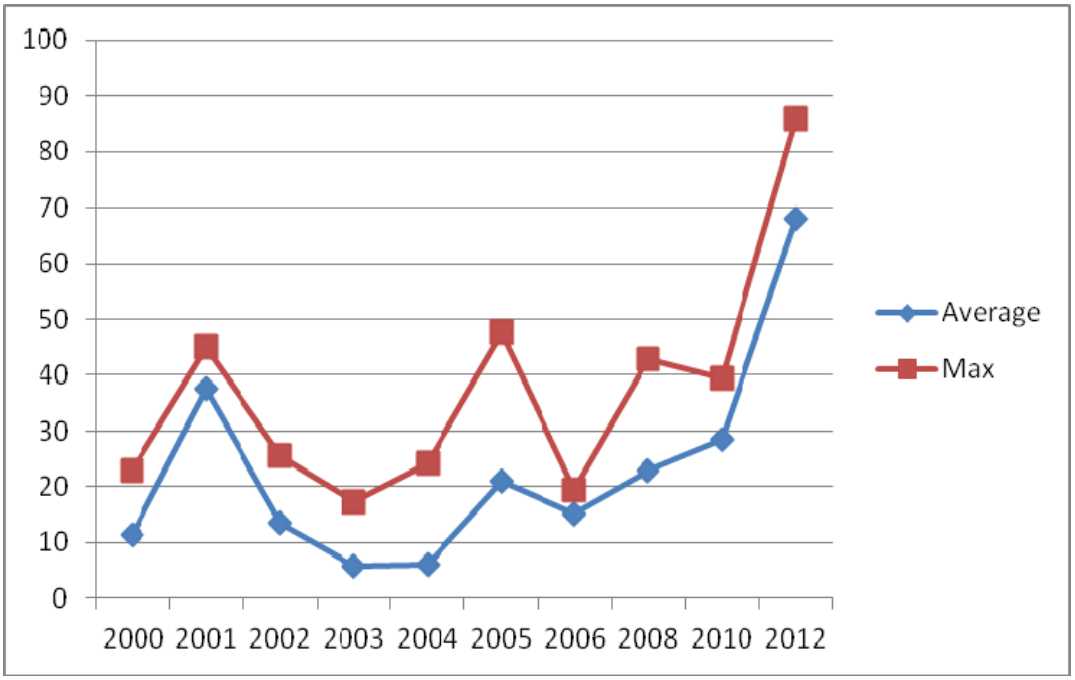

Figure 14. Average and Maximum Sightings/Hour on Transect 10, 2000-2012

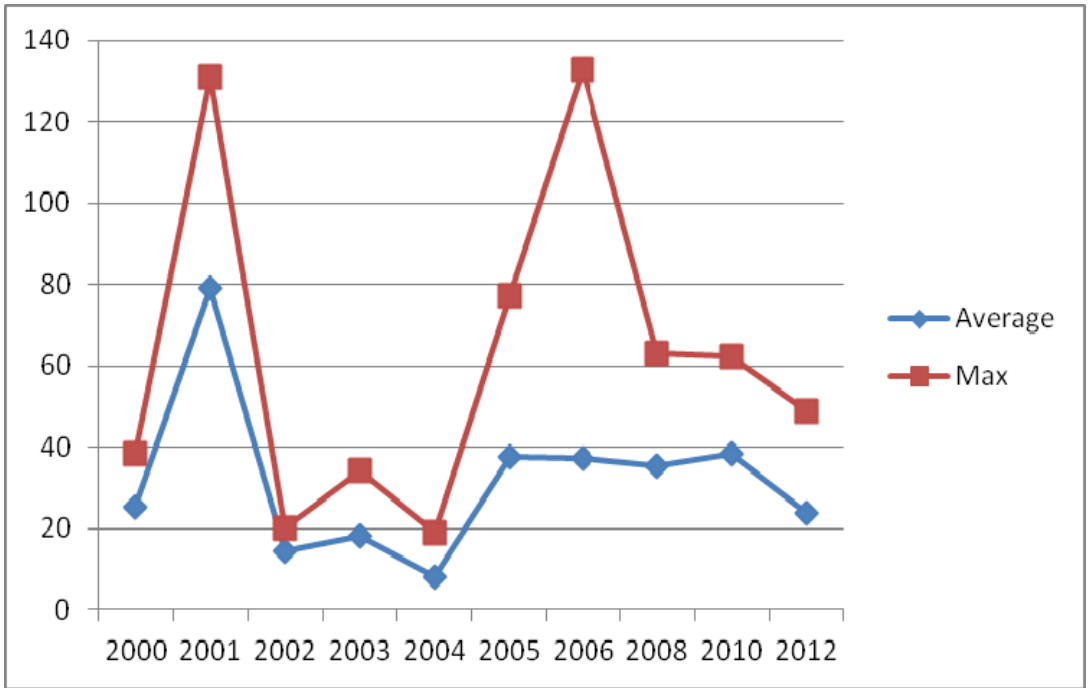

Figure 15. Average and Maximum Sightings/Hour on Transect 11, 2000-2012

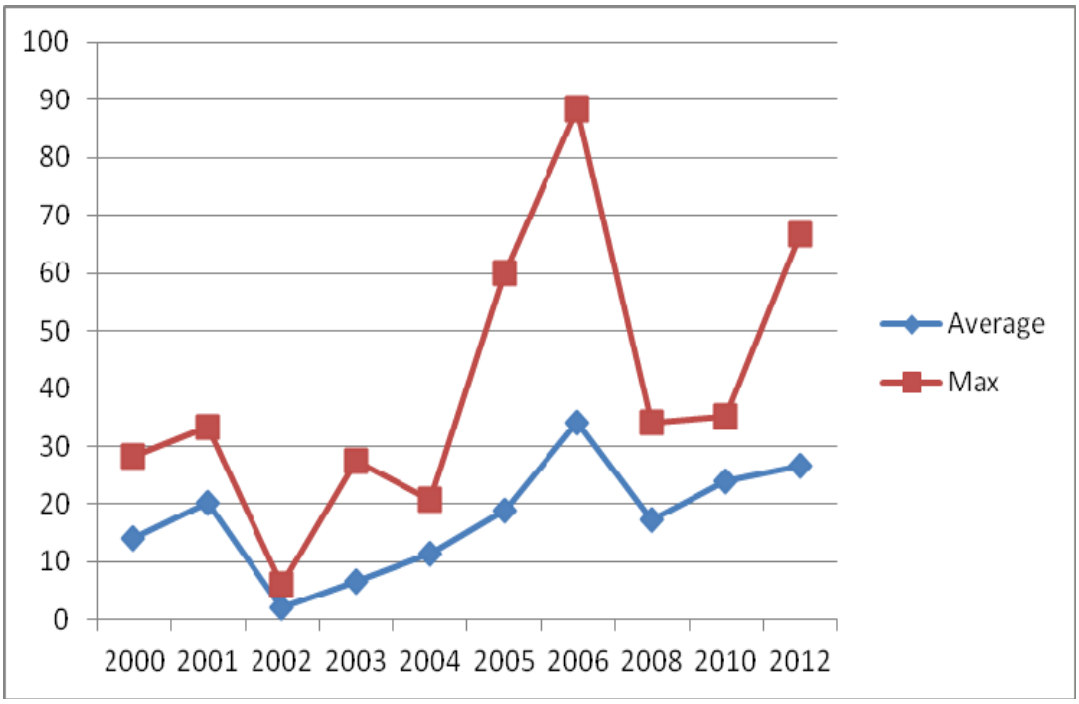

Figure 16. Average and Maximum Sightings/Hour on Transect 12, 2000-2012

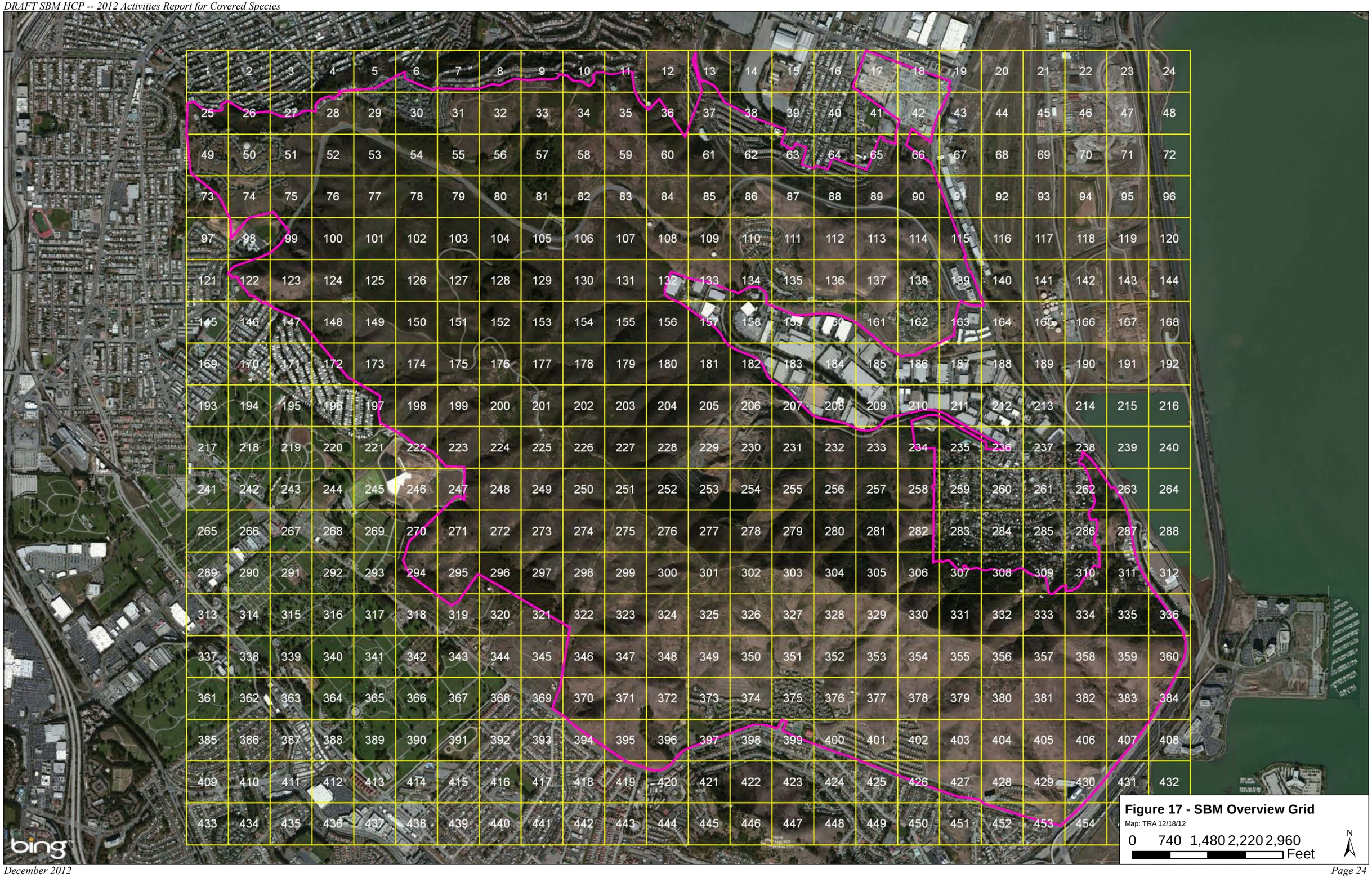

Figure 17 - SBM Overview Grid

Map: TRA 12/18/12

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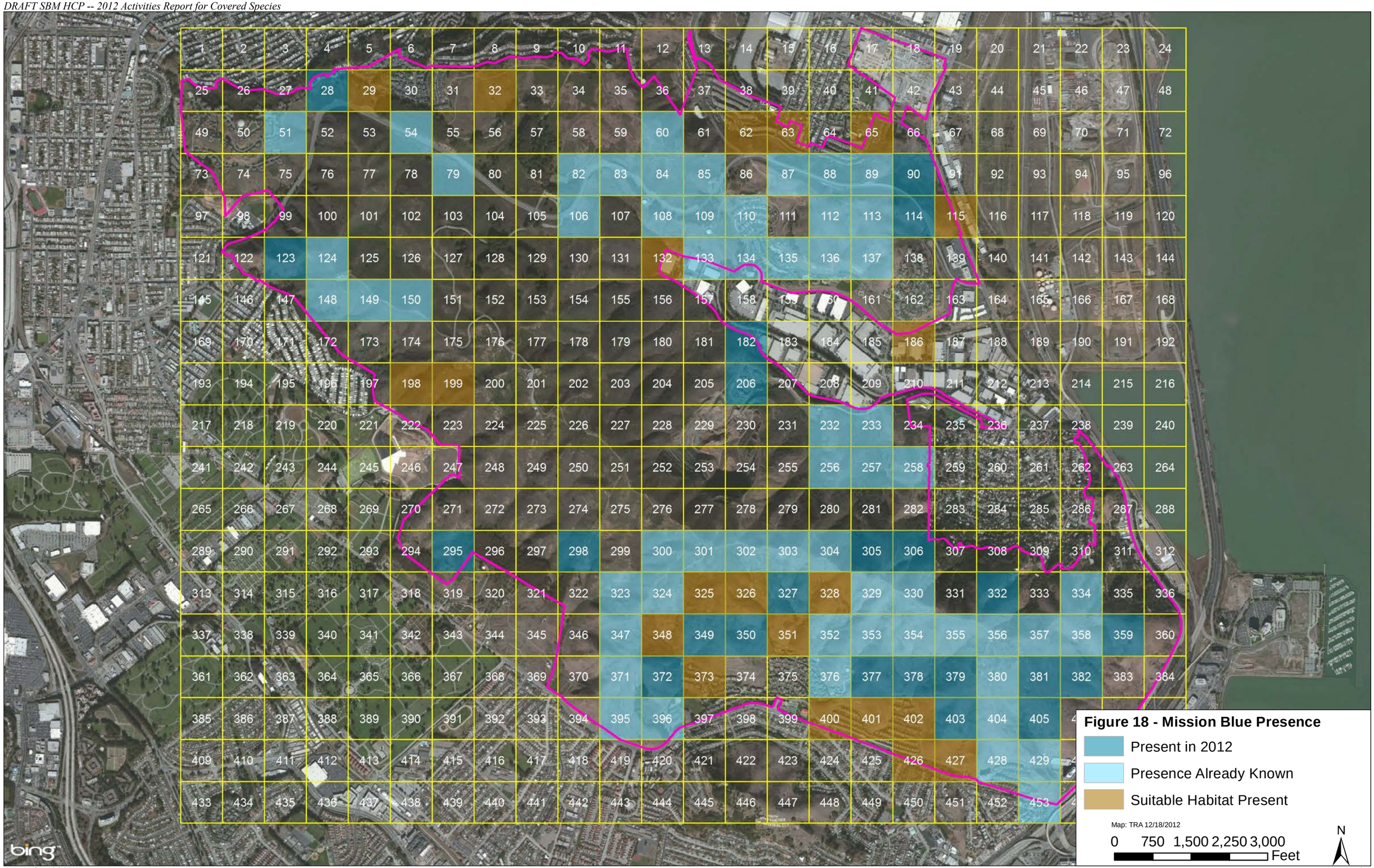
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Figure 18 - Mission Blue Presence
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Suitable Habitat Present
Map: TRA 12/18/2012
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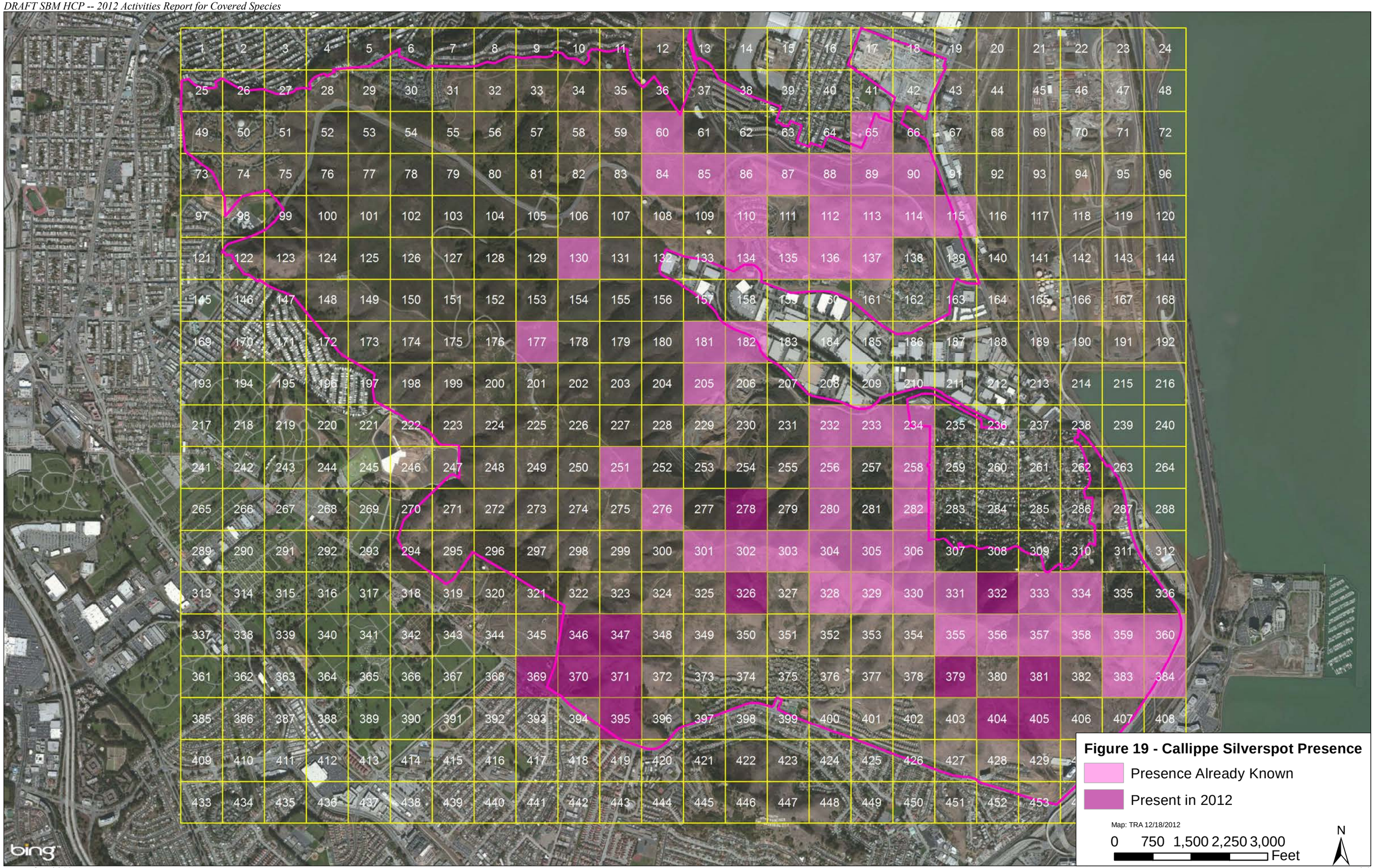
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bing
Figure 19 - Callippe Silverspot Presence
Presence Already Known
Present in 2012
Map: TRA 12/18/2012
0 750 1,500 2,250 3,000
Feet
N

Figure 20 - Callippe Silverspot Occupied Habitat, Presence Found in 2012

Map: TRA 12/18/2012

Appendix A: Analysis of Butterfly Survey Data and Methodology from SBM HCP (1982-2000) - Survey Methodology

Analysis of Butterfly Survey Data and Methodology from San Bruno Mountain Habitat Conservation Plan (1982–2000).

2. Survey Methodology

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USC Center for Sustainable Cities

Cover Photo:
Mission blue butterfly at San Bruno Mountain, March 2003 (T. Longcore)

Preferred Citation:
Longcore, T. 2004. *Analysis of Butterfly Survey Data and Methodology from San Bruno Mountain Habitat Conservation Plan (1982–2000). 2. Survey Methodology*. University of Southern California GIS Research Laboratory and Center for Sustainable Cities, Los Angeles, California.

Introduction

The butterfly monitoring scheme for the San Bruno Mountain Habitat Conservation Plan from 1982 to 2000 was plagued with a number of methodological difficulties. These included a haphazard rather than random survey design, no repeatability between years, and varying geographic coverage. While some information can be extracted from the "wandering surveys" conducted on San Bruno Mountain, a more rigorous survey design is necessary to allow managers to draw statistically significant inferences about the status of the butterflies and their responses to management actions. Indeed, since 1998, standardized transects have been established to monitor butterflies at San Bruno Mountain.

This report discusses the factors that should be considered in the further development of a new monitoring protocol. While it provides as detailed guidance as possible, the ultimate survey design must incorporate the considerations of those who will implement the surveys. Feasibility on paper does not always translate well to the field.

This report draws on the analysis of mission blue butterfly and Callippe silverspot butterfly survey data completed by USC. It adds to that analysis a quantitative description of the flight period of each butterfly, derived from survey data collected 1982-2000.

Survey Methodologies

The survey methodology for both butterfly species should be revised to meet the conditions necessary for statistical inference across the whole study area. The surveys should assess the relative population size from year to year, as well as the distribution of occupancy. Based on Longcore et al. (2003) I recommend a combination of fixed transects and presence surveys, both using the 250 m grid system developed to analyzed the "wandering transects" (Figure 1).

Fixed transects

The purpose of fixed transects (i.e., "Pollard walks", Pollard 1977) is to provide a repeatable measure to draw inference about the overall population size in any given year, and to describe the abundance curve of the butterflies within any given season to aid in analysis of presence data. The transects cannot be placed simply in the locations with the most butterflies because of the phenomenon of regression to the mean. Rather their locations must be chosen randomly from the universe to which inference is to be made. Because the survey methodology intends to draw inference about the entire San Bruno Mountain Habitat Conservation Plan area, the first inclination is to select fixed transect sites randomly from all cells. It may be reasonable, however, to assume that locations within the Habitat Conservation Plan area that have not supported butterflies for the past 20 years are unlikely to support them in the future, and even if butterflies were introduced, they would not behave differently than other previously occupied area. If

this assumption is acceptable, then fixed transects can be chosen randomly from the universe of cells that have been occupied in the past by each or both butterflies, which would avoid the frustrating possibility of conducting fixed transects at locations unoccupied by the butterfly.

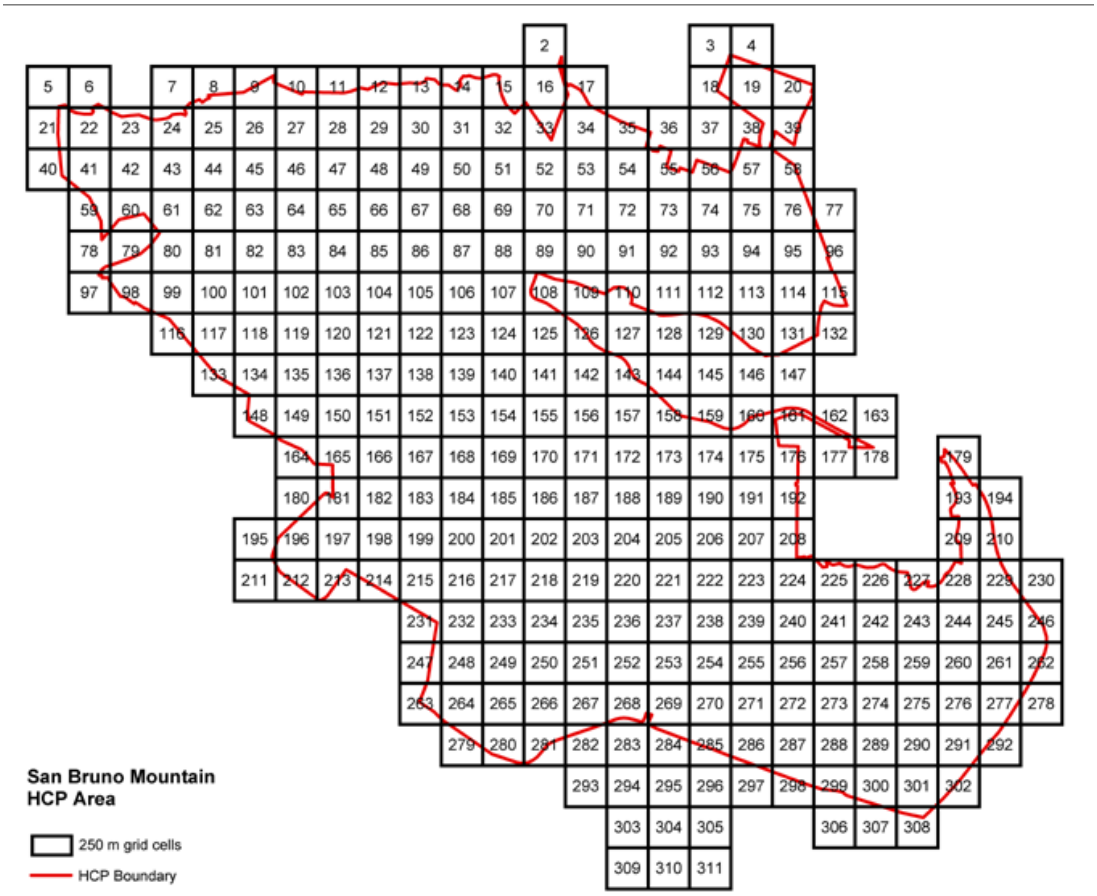

Figure 1. Numbered grid for analysis of butterfly survey data, San Bruno Mountain HCP.

The next questions are the number of fixed transects, their length, and frequency of survey. These interrelated issues are influenced by the availability of resources. It is imperative for population estimation techniques that fixed transects be conducted at least every ten days during the flight season of each butterfly. Further, they should be sufficiently long within each cell to fully survey that cell (>250 m). The layout of the survey within the cell should follow the guidelines established by Thomas (Thomas 1983) so that the transect is not a sample of the habitat within the cell, but rather a complete survey. The number of these transects then depends on a power analysis in which one must assume the amount of variation between sites. Effectively this variation should be low, and relatively few (e.g., 5) fixed transects are required relative to the total number of cells (310).

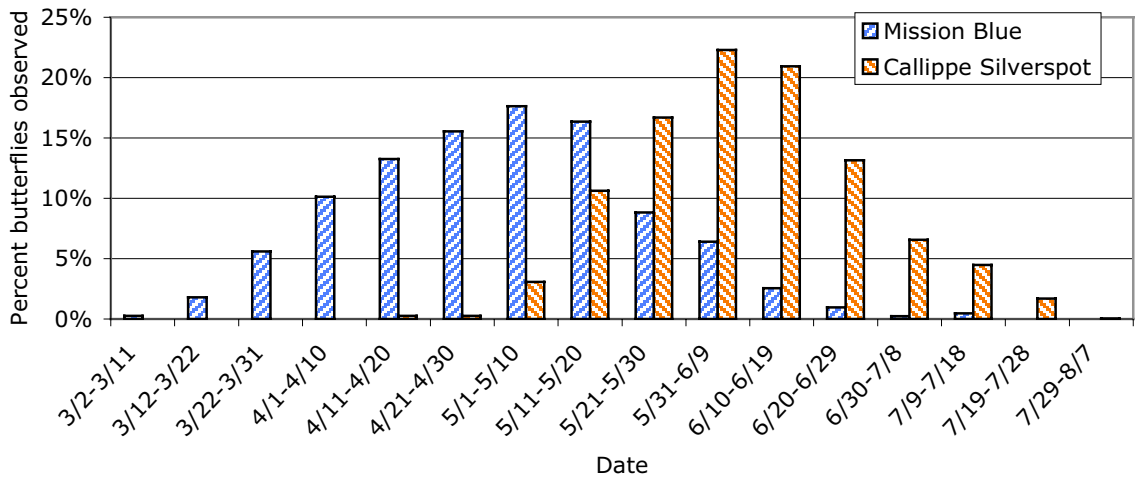

Figure 2. Distribution of adult mission blue butterfly and Callippe silverspot butterfly observations by date, 1982-2000.

The flight season of mission blue butterfly and Callippe silverspot butterfly combined almost always falls within a 140 day window from March 12 to July 28. Most years the combined season will be shorter. As a practical matter, abundance transects will take at a maximum 14 visits during this period.

Presence Surveys

The number of fixed transects must also be balanced against the desire to have spatial and temporal resolution of trends in occupancy, which require a different type of survey. Presence surveys must be spread throughout the flight season of the butterfly species, according to the characteristics of the species (Zonneveld et al. 2003). The number of surveys, the size of the population to be detected, and probability of encountering a butterfly are interrelated. With fewer surveys, the probability of encountering a small population decreases. More surveys or more butterflies always increase the probability of encounter, and a demand for greater probability of encounter requires either a larger population to detect or more surveys. For any survey methodology, one must decide two of the variables to determine the third. For example, if only four surveys are possible financially and a 95% confidence of locating a population is desired, only populations of a certain size (e.g., 10 individuals) will be detected with that confidence. Analysis of these tradeoffs are necessary to devise a survey methodology; once data are collected, complete analysis of them can calculate the actual detection probability, taking into account many factors that determine visibility of the species (MacKenzie et al. 2003).

Drawing on analysis of other butterfly species (Zonneveld et al. 2003), I suggest three surveys, spaced optimally, to evaluate cells for presence. Counts need not be conducted

on such visits, only presence or absence recorded. All three visits must be made, even if presence is already established, to allow for application of the best available trend analysis algorithms (MacKenzie et al. 2003). Three surveys should be adequate to detect populations of five or more visible butterflies within a cell 90% of the time (see Figure 3, Zonneveld et al. 2003). Subsequent analysis will determine the actual detection probability.

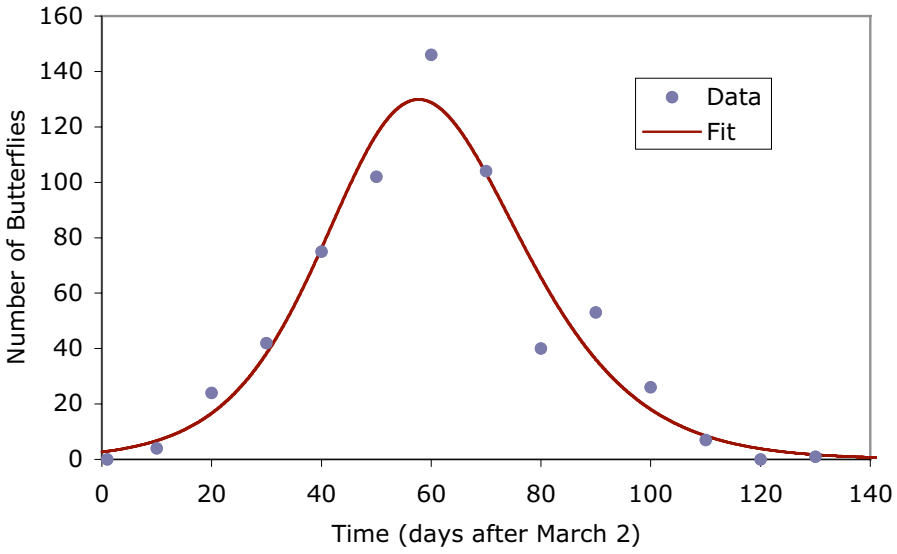

Figure 3. Fit by INCA of Zonneveld model to observed abundance curve of mission blue butterfly by ten-day increments at all locations across San Bruno Mountain, 1990.

The question then arises of how to time the surveys to maximize the chance of encountering each species during presence surveys. Zonneveld et al. (2003) provide guidance for this question, and a table to identify the optimal spacing of five survey days based on known flight period characteristics. These characteristics are the death rate of the butterfly (alpha, α), the spread of emergence of the butterfly within years (beta, β), and the variation (s.d.) in date of peak emergence (mu, μ) over time. I produced estimates of these values by aggregating survey data from each year of wandering transect data (1982–2000) at SBM into ten-day periods, and fitting the Zonneveld model to the abundance curve with INCA (INsect Count Analyzer) (Zonneveld 1991; Longcore et al. 2003). This can only be expected to provide a very rough estimate, because the use of aggregate data from nonreplicated transects violates assumptions of the model. Nevertheless, the model fit these aggregate data for many years for both species (e.g., Figure 3) with the use of prior information to constrain the death rate. I used the results of these analyses to assign each of the variables to low, moderate, or high categories as defined by Zonneveld et al. (2003).

Table 1. Estimated flight period characteristics of mission blue butterfly and Callippe silverspot butterfly at San Bruno Mountain, 1982–2000.

	Mean death rate (α)	Mean dispersion of eclosion (β)	Mean date of peak eclosion (μ)	Variation in peak eclosion (s.d. μ)
Callippe silverspot	0.16 (moderate)	5.8 (moderate)	June 4	14.7 (high)
Mission blue	0.15 (moderate)	8.9 (high)	April 20	10.7 (moderate)

These results provide an indication for the general range of these flight period values for each species, but should be interpreted with consideration of the numerous assumptions violated in the application of the model deriving them. The estimates are consistent with observable patterns in the flight period of the two species. For example, the flight season for mission blue butterfly is generally spread out over a greater period, while Callippe silverspot butterfly has a more distinct peak in most years — this qualitative observation is confirmed by the higher beta value for mission blue.

Based on these estimates of flight period characteristics and Table 1 in Zonnveld et al. (2003), surveys for mission blue should be conducted all approximately five days following the average peak emergence. For Callippe silverspot, the same analysis suggests surveying three times, ten days before peak emergence, five days after, and twenty days after.

Implementation of this general advice must be done in the field, with consideration of appropriate weather conditions to survey. Ideally, the presence surveys for mission blue butterfly should be conducted during an intensive period during the end of April and the beginning of May. Presence surveys for Callippe silverspot should be conducted during the last week of May, second week of June, and end of June (Table 2).

Cost and Feasibility

Combining the survey scheme for both species would allow surveys during the overlapping portion of the flight season to be used to record information about both species. In doing so, it is possible that certain sites will be chosen for surveys that have never supported one or the other species. This has certain benefits, because by selecting presence survey sites by random from the cells occupied at one time by either species allows for inference to these cells as well.

The total hours required for abundance surveys for both species (fixed transects) is 14 visits times 5–10 sites times an average of 1.5 hours per survey, or 210 hours. At an average cost of $50/hour for permitted surveyors, the cost would be $5,250–10,500.

Presence surveys should take approximately one hour on average per cell, including travel time. Equal effort should be expending for each species, with three visits per cell. Presence surveys should be conducted separately for each species following the timing suggested above. Because the survey scheme should provide information about specific

habitat areas to guide management, the return interval for surveying cells should be relatively short (2-3 years). A three year return interval for mission blue butterfly (218 cells) would require 73 cells surveyed per year at a cost of $10,950, and for Callippe silverspot butterfly (165 cells), 55 cells per year at a cost of $8,250. The cost of abundance and presence surveys together would be $24,450–29,700, not including data analysis and report preparation.

Table 2. Suggested frequency and dates for fixed transects (abundance surveys) and cell surveys (presence surveys) for mission blue butterfly (MB) and Callippe silverspot butterfly (CS).

Date	Abundance Survey	Presence Survey
3/12–3/22	MB	
3/23–3/31	MB	
4/1–4/10	MB	
4/11–4/20	MB	
4/21–4/30	MB	MB (3 intensive)
5/1–5/10	MB	
5/11–5/20	MB, CS	
5/21–5/30	MB, CS	CS
5/31–6/9	MB, CS	
6/10—6/19	MB, CS	CS
6/20–6/29	MB, CS	CS
6/30–7/8	CS	
7/9–7/18	CS	
7/19–7/28	CS	

Thus, for approximately $30,000 per year a survey scheme could be implemented that would allow for comparison of population sizes across years and permit statistical inference about the status and trends of these two butterfly species. This estimate depends on the actual time required for each type of survey and the actual cost of hiring surveyors. It should provide, however, a framework for discussion.

The cost estimate does not include the cost of setting up the grid of cells on San Bruno Mountain. This initial effort will be costly, and require a substantial off-season effort with a Geographic Positioning System unit to identify the corners of each cell. This effort would identify cells that cannot or should not be surveyed for some reason, providing information to adjust the survey design.

Well-trained volunteers could contribute significantly to the proposed survey effort. The presence surveys could be assigned to volunteers once the cell system was established, and a volunteer could be responsible for conducting six appropriately timed visits to one or many cells each year. Such volunteers should be permitted by the U.S. Fish and Wildlife Service. Given the enormous effort expended by volunteers on behalf

of San Bruno Mountain over the years, such integration of volunteers into the survey protocol may be possible.

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