FINAL REPORT
YOSEMITE SLOUGH WATERSHED WILDLIFE SURVEY
2003-2004

Funded by a grant from CALFED under contract with Arc Ecology

LSA

July 27, 2004

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INTRODUCTION

This report presents a description of the study area and the results of the wildlife surveys conducted between January 2003 and April 2004 at the Yosemite Slough study area. The surveys were designed to identify and document the wildlife species that occur within the Yosemite Slough watershed study area and to assess the wildlife use of various sub-areas within the study area. Birds in general and waterbirds[1] in particular were the species groups most easily observed within the study area and also the groups that showed the highest number of individuals and greatest diversity of species. Mammals, reptiles, amphibians, and butterflies were also surveyed throughout the survey period.

Surveys were conducted by teams of local youth led by experienced wildlife biologists. LSA wildlife biologists developed the survey protocol and schedule and analyzed the results. LSA trained the team leaders and youth team members in the use of the protocol and conducted periodic field visits as part of an overall quality control program to ensure the integrity of the data.

This analysis provides a description of baseline conditions within the study area and may be used for comparative purposes if subsequent studies are conducted.

STUDY AREA

The Yosemite Slough study area is located on the San Francisco Bay shoreline within the City and County of San Francisco, California. The study area lies south of the former Hunter's Point Naval Shipyard and north and east of Candlestick Park (Appendix A - Map 1). The study site encompasses both the developed and undeveloped portions of the Candlestick Point State Recreation Area (SRA) as well as the adjacent open water areas between Hunter's Point Naval Shipyard and the peninsula that forms the eastern extension of Candlestick Point SRA. From north to south, the study area is roughly bordered by Thomas Avenue, Ingalls Street, Carroll Avenue, Fitch Street, Arelious Walker Drive, and Hunters Point Expressway.

Ten sub-areas were identified within the Yosemite Slough study area and are shown in Map 2 (Appendix A). Four of the sub-areas were primarily aquatic sites of open water, salt marsh, and/or tidal mudflats. Aquatic sub-areas included Yosemite Slough, South Basin, Outer Basin, and Cove. Salt marsh vegetation including cordgrass (*Spartina* sp.), pickleweed (*Salicornia virginica*), saltgrass (*Distichlis spicata*), gumplant (*Grindelia* sp.), and alkali heath (*Frankenia salina*) were found mainly at the west end of Yosemite Slough where daily tidal fluctuations inundate the marsh during high tides. At low tides the mudflats of Yosemite Slough are exposed as far east as the South Basin. Smaller patches of salt marsh vegetation occur in the South Basin near the abandoned boat launch. The South Basin, Outer Basin, and Cove are primarily open water areas, although the daily tidal cycle exposes narrow mudflats along the shorelines of these areas.

[1] Waterbirds are defined as those families of birds of which most or all members are associated with fresh- or salt-water habitats.

Six primarily terrestrial sub-areas were also designated in the Yosemite Slough study area: Upland 1, Upland 2, Upland 3, the Parking Lot, Rock Garden, and Park. Uplands 1-3 are vacant lots dominated by ruderal vegetation such as fennel (*Foeniculum vulgare*) and non-native grasses (e.g., wild oats [*Avena fatua*], Italian ryegrass [*Lolium multiflorum*]). Shrubs, mainly coyote brush (*Baccharis pilularis*), are scattered throughout these sub-areas. Some trees and shrubs were planted in Upland 3 at the west end of the Yosemite Slough as part of an earlier enhancement project. The shoreline of the Upland 1is broken rubble interspersed with salt marsh vegetation. Upland 2 also has a shoreline mostly composed of broken rubble although a small sandy beach is also present. The Parking Lot is a paved and graveled parking lot used as overflow parking for Candlestick Park and is largely devoid of vegetation. The shoreline of the Parking Lot is mainly broken rubble, although a small patch of salt marsh grows near the boat ramp (South Basin). The Rock Garden is another ruderal upland dominated by non-native grasses, coyote brush, and fennel. The shoreline of the Rock Garden is primarily broken rubble (bricks). The Park is the landscaped portion of the State Recreation Area and is dominated by turf, Monterey pines (*Pinus radiata*), coast live oak (*Quercus agrifolia*), and paved and graveled paths. A sandy beach is located along the shoreline of the Park near the picnic tables. The remainder of the shoreline in the Park is primarily riprap.

MATERIALS AND METHODS

The complete survey protocol can be found in the *Wildlife Survey Protocol, Yosemite Slough Watershed Project, San Francisco, California*[2]. The protocol provides detailed instructions on how to conduct the surveys, the dates and times of the surveys, the survey routes, and copies of the data sheets used to record data in the field. A summary of the methods and quality control measures is included below. LSA searched the California Natural Diversity Data Base (CNDDB) for occurrences of special status wildlife species in the vicinity of the study area. No occurrences of special status wildlife were recorded for this area.

EQUIPMENT

Observers conducted visual surveys using binoculars and spotting scopes. One spotting scope was provided for each survey area (Northern Survey Area and Southern Survey Area). Spotting scopes were used mainly to survey the large expanses of open water. Youth surveyors were provided with reference books for all target species. Rulers and latex gloves were carried by each team to handle and identify scat.

TRAINING

Team leaders and youth surveyors were trained in the use of the protocol by LSA wildlife biologists Tim Lacy and Steve Granholm. Training occurred on October 9 and December 7, 2002, and January 25, May 3, and September 13, 2003. Training entailed identification of survey routes, instruction in methods to avoid double-counting, explanation of the data sheets, instruction in recording data, and practice in identifying wildlife.

SURVEY PERIOD

A total of 29 wildlife surveys were conducted at the Yosemite Slough study area between January 11, 2003 and April 3, 2004. Surveys were suspended during June and July 2003, a period when shorebird and waterfowl abundance is typically lowest in the bay. This period also coincided with summer vacation for the youth surveyors and team leaders. The survey period was divided into four-week scheduling blocks. In each four-week block, wildlife surveys were conducted on two Saturdays between 10:00 AM and 2:00 PM. The complete schedule can be found in the survey protocol.

[2] Wildlife Survey Protocol, Yosemite Slough Watershed Project, San Francisco, California. Prepared by LSA Associates, Inc., Pt. Richmond, CA for Golden Gate Audubon Society. January 2003.

FIELD SURVEYS

Habitats present within the study area were identified and mapped on October 19, 2002 by LSA wildlife biologist Tim Lacy. The entire study area was walked and notes on the various habitat types present within the study area were recorded. This initial reconnaissance of the study area also was used to identify and map survey routes that would allow the greatest possible coverage of the study area within the approximately three-hour survey window.

On most survey dates, field surveys were conducted by four teams composed of an experienced wildlife biologist as team leader and 2-4 youth surveyors[3]. The study area was divided into a Northern Survey Area and a Southern Survey Area (Appendix A - Map 2). Within each survey area, two routes were established, an upland route and a shoreline route. The upland route team focused primarily on the terrestrial habitats and landbirds within the survey area while the shoreline route team focused primarily on the aquatic habitats and waterbirds. All birds, mammals, reptiles, amphibians, and butterflies observed along the survey routes were identified to species (if possible) either by sight, call, song, tracks, or scat. Methods to avoid double-counting were implemented during the surveys. Counts for each species observed were recorded on data sheets by sub-area. A separate data sheet was used for each survey area and route. Bird counts were kept on separate data sheets from counts for amphibians, reptiles, mammals, and butterflies. Environmental conditions including wind, temperature, and tidal stage were also noted on the data sheets.

Birds

In each survey area, one group had responsibility for counting waterbirds and the other for counting land birds. Typically, the waterbirds were found along the shoreline, on the water, or on the off-shore rocks, piers, and pilings. Land birds were typically found in the upland areas. The shoreline team made occasional detours into the upland areas to count waterbirds (i.e., killdeer) using the uplands. The upland team made occasional detours to the shore to count land birds (i.e., sparrows) along the shoreline. This overlap allowed leaders to separately note species that might have been missed by the group responsible for a particular area. Adjustments to the data sheets to account for missed species were made at the end of the survey.

Each survey team made its way through the designated survey area at a pace sufficient to allow coverage of the entire area within the 3 hour survey window. Specific viewing points were not pre-determined and it was up to the leader of each group to identify good viewing points that allowed accurate and easy identification and enumeration of birds within the survey area. Leaders made a concerted effort to minimize backtracking along the survey routes. Birds were identified either visually or by song or call (auditory identification).

All birds observed were recorded, even if it was not possible to make a positive identification of a species, if it could be identified as a particular type of bird (i.e., unidentified gull). Descriptive terms used for unidentified birds included: small shorebird (dunlin-sized or smaller), large shorebird

[3] On a few occasions, all four teams could not be staffed due to a shortage of leaders or youth surveyors. In such cases, the surveyors formed two teams, one to cover the northern and one to cover the southern portion of the study area.

(dowitcher-sized or larger), western or least sandpiper (unable to discern species), Gull sp. (unidentified gull), and Raptor sp. (unidentified raptor).

Mammals, Reptiles, and Amphibians

In each survey group (upland and shoreline), one youth surveyor was assigned each day to survey for small mammals and their sign. This surveyor was also responsible for surveying for reptiles, amphibians, and butterflies. The leaders worked with the youth surveyors to help them identify these species and their sign and record the information on the data sheets. Upon entering a new area, the surveyor scanned it for activity of non-avian species. If a burrow or colony of small mammals was found, the colony was observed for 2 minutes and the maximum number of individuals observed during that time was recorded. The surveyors also looked for tracks, scat, and other signs of mammal, reptile, and amphibian activity by turning over rocks, logs and other debris.

Butterflies

Concurrent with searching for mammals, reptiles, and amphibians, one surveyor in each team searched for and identified butterflies using the study area. When a butterfly was observed, the surveyor recorded pertinent information and made an identification using the field guides.

DATA MANAGEMENT

Data from the 29 survey dates was entered into a Microsoft Access database for later analysis. Experienced Golden Gate Audubon Society volunteers, familiar with the database structure, entered all the data. The structure of the data base was modeled on a previous bird census project in Alameda County, which was also conducted by Golden Gate Audubon Society.

QUALITY CONTROL

In order to ensure the integrity of the data collected during the surveys, LSA and Golden Gate Audubon Society trained the survey leaders and youth in the implementation of the protocol, methods to avoid double-counting, and data collection. Arthur Feinstein (Golden Gate Audubon Society) conducted periodic tests of the team leaders' abilities to identify species and to assess the consistency between the leaders in their identifications and counts. LSA biologists Tim Lacy and Steve Granholm observed the survey teams and made recommendations as to how to improve the data collection by following along with one or more survey team during two surveys (January 25 and May 3, 2003). An LSA biologist also walked all four routes with the survey leaders on December 7, 2002, prior to the start of the survey period.

LSA checked the accuracy of the data entry into the computer database by verifying data entry for 10 percent of the data sheets. No errors in data entry were found during the verification. The verified database was used for all data summaries and graphs.

Two data sheets were found to be missing, however, and we assume that these sheets were misplaced, lost, or never turned into the survey coordinator. Attempts to locate the data sheets were

unsuccessful. Missing data sheets were for the Southern Survey Area, upland route on May 10, 2003, and the Northern Survey Area, upland route on January 10, 2004.

RESULTS

HABITATS

Map 3 (Appendix A) shows the habitats present within the study area. Four habitats are present: 1) urban (houses, parking lots, commercial and industrial buildings, landscaped park), 2) non-native grassland (vacant lots and undeveloped parcels), 3) salt marsh (Yosemite Slough), and 4) open water (bay).

The substrate along the shoreline of the study area is composed mostly of small rubble such as broken bricks that had been used as fill along the shoreline. Riprap composed of large rocks was placed along exposed sections of the shoreline of the Rock Garden and Park to armor the shoreline in these areas. Small sandy beaches were observed at two locations, one in the South Basin opposite Double Rock (Upland 2) and the other in the Cove (in the Park). In a few places, the shoreline is composed of mud, unarmored by riprap or rubble.

SPECIES DIVERSITY

During the survey period, the survey teams observed 148 species using the study area (not counting unidentified species that overlap with identified species, i.e., "gull species" overlaps with "western gull"). The number of species observed is shown in Table 1 (Appendix B) by year, taxon and guild. Species diversity in 2004 was about 2/3 that of 2003 and is due (at least in part) to a much smaller number of surveys in 2004 (7 surveys in 2004 and 22 surveys in 2003). Extending the 2004 surveys through May and August-December would likely have shown a similar number of species using the study area in both years. All species observed in 2004 were also observed in 2003. Birds had the highest diversity within the study area, followed by butterflies. Both of these taxa can fly, making it easier for them to reach areas that are relatively isolated from other open space areas and native habitats.

One hundred eighteen species of birds were observed in the study area during the survey period. All the bird species observed in 2004 were first observed in 2003, so no new species were added to the species list as a result of the 2004 surveys. During both 2003 and 2004, the number of species by guild showed a consistent pattern with landbirds showing the greatest number of species (49 species in 2003), followed by shorebirds, other waterbirds, waterfowl, gulls and terns, and raptors (in descending order). Landbirds, primarily passerines, dominated the terrestrial habitats, while shorebirds, other waterbirds, and waterfowl dominated the aquatic sub-areas.

Fourteen butterfly species were observed within the study area during the survey period. This represents about 15 percent of the species recorded for San Francisco County[4]. Butterflies were

[4] Butterflies of North America. USGS, Northern Prairie Wildlife Research Center. http://www.npwrc.usgs.gov/resource/distr/lepid/bflyusa/chklist/states/counties/ca_75.htm

observed in the terrestrial sub-areas (e.g., Park, Rock Garden) as well as along the shoreline of the Cove and Outer Basin.

The lowest diversity was seen in the amphibians, with only one species observed. The bay does not provide suitable aquatic habitat for amphibians and there are no freshwater habitats on or near the study area that could serve as breeding habitat for amphibians such as frogs and toads. The isolation of the study area and low vagility of amphibians in general make it unlikely that the diversity of amphibians observed would increase markedly even with a longer survey period.

Reptiles also had a low diversity, but higher than first expected. Three snake species and two lizard species were observed on the site. The abandoned fields, extensive debris (providing cover), and presence of prey (e.g., mice, invertebrates, salamanders) provide suitable habitat for these species. The upland areas dominated by ruderal vegetation and non-native grassland were the areas that supported the snake and lizard species. One notable exception was the observation of 21 southern alligator lizards found in silvery beachweed along the shoreline of the South Basin. These 21 lizards were all juveniles and may have been from a single clutch that had been laid in the silvery beachweed.

Mammalian species diversity was also low in the study area. Three of the 10 species observed were non-native species (feral cats, feral dogs, and Norway rats) that can have significant impacts on native birds and mammals through predation. Rodents were the most diverse mammalian species in the study area (4 species). Lagomorphs (rabbits) and pinnipeds (seals) were represented by one species each[5].

Figures 1-22 (Appendix C) show species diversity for each of the 10 sub-areas within the Yosemite Slough study area (not counting unidentified species that overlap with identified species; see Table 1). Birds are shown separately from the other species.

MAXIMUM ABUNDANCE

The maximum number of birds observed in a single day was 2,347 individuals on January 10, 2004. In the 29 surveys conducted between January 2003 and April 2004, the maximum single-day counts for birds exceeded 2,000 individuals during five surveys. In the same period, between 1,000 and 2,000 birds were observed during 17 surveys, and fewer than 1,000 individual birds were observed during seven surveys (lowest number of birds observed on a single day was 471 on August 23, 2003).

Table 2 (Appendix B) shows the maximum number of individuals of each species observed during the survey. The species that was most abundant on a single day was the double-crested cormorant. On a single day, 747 individuals were observed over the entire study area. Cormorants roost in large numbers on the piers of the Hunter's Point Naval Shipyard and this accounts for the large numbers observed. Other species with large numbers of individuals using the study area in a single day included western gull and California gull with 622 and 563 individuals observed. These species were commonly observed in the parking lot. Shorebirds also were abundant in the study area. Several

[5] One other pinniped, the California sea lion (*Zalophus californianus*), was observed in the study area by LSA biologist Steve Granholm on May 3, 2003, but was not reported by the survey teams. Ten sea lions were hauled out on a flat, floating structure in the Outer Basin.

hundred western sandpiper (358), least sandpiper (245), dunlin (194), and unidentified sandpipers (*Calidris* sp.) (541) were observed in the study area during single survey days. Yosemite Slough and the shoreline of the Cove, South Basin, and Outer Basin were areas where large numbers of these species were observed.

The South Basin, Cove, and Outer Basin also supported large numbers of waterfowl. Species with the highest single-day abundance on the site included greater scaup (646) ruddy duck (510), surf scoter (267), and bufflehead (183). Other waterbirds that were common include the Clark's grebe and western grebe, with single-day maximum numbers of 103 and 115 individuals, respectively.

Terrestrial habitats within the study area supported large numbers of native species such as white-crowned sparrows, western meadowlarks, and house finches. In a single survey, 175, 146, and 143 individuals were observed throughout the study site, respectively. The Park, Rock Garden, and Uplands 1-3 were where these species were commonly observed. Non-native species such as European starlings also had high single-day abundance (247). Starlings were found in the same sub-areas as the native white-crowned sparrows, meadowlarks, and house finches. Few raptors and no owls were observed during the surveys. The most common raptor was the red-tailed hawk. Eight (8) red-tailed hawks were observed in the study area during a single survey.

Although only a single species of amphibian (California slender salamander) was found in the study area, it was fairly common in the winter. The maximum number observed in a single day was 43 individuals. Reptiles observed in large numbers included western fence lizards (49 maximum) and southern alligator lizards (22 maximum).

The most abundant mammal observed was the California ground squirrel; 143 individuals were observed in a single survey. These rodents commonly use the Park and Rock Garden where they burrow along the shoreline and in the soil mounds. Also of note was the observation of nine harbor seals in the study area during a single day. This species, protected under the Marine Mammal Protection Act (MMPA), was observed in the Outer Basin, but was not seen hauling out within the study area[6]. Harbor seals may occasionally haul out on the beaches or rocks within the study area, particularly in areas removed from human disturbance (i.e., the north shore of the Outer Basin).

Common butterflies in the study area included cabbage whites, anise swallowtails, and common checkered skippers. The maximum number of individuals of each species observed in a single day was 64, 27, and 22, respectively.

MEAN ABUNDANCE

Table 3 (Appendix B) shows the mean abundance per survey for each species observed. The most abundant species observed in the study area throughout the study period was the ruddy duck. This species was regularly observed in large numbers in the Cove (mean 89.69), South Basin (mean 75.41), and Outer Basin (mean 15.24) sub-areas. Other species with high mean abundance include the cormorants, greater scaup, sandpipers, California gull, and western gull. Aquatic habitats within

[6] As noted above, 10 California sea lions were observed by LSA at a haul-out site on a single day, but were not reported during the survey. This species is also protected under the MMPA.

the study area provided habitat for large numbers of waterbirds and open, flat upland areas (i.e., parking lots) were heavily used by gulls.

Mean abundance by month is shown in Figures 23-26 (Appendix C) and is separated out by guild and taxon. A number of taxa and guilds show a seasonal abundance that peaks at one time of the year. Gulls and terns showed a steady increase in abundance from the fall (September) through mid-winter (January) and declined into the spring. In the first part of the survey period (January 2003 through May 2003), waterfowl abundance was relatively high, while in the second part of the survey period (November 2003 through April 2004), waterfowl abundance increased to a peak in mid-winter (January 2004) then declined. Shorebird abundance showed a similar trend, with peaks in mid-winter (January). In the spring of 2003, shorebirds also showed a peak in April that went counter to the trend that was seen in 2004, when abundance decreased from the peak in mid-winter through spring. Landbirds (primarily passerines) also showed a seasonal high in late fall and declined into the spring. Like gulls and terns, other waterbirds showed a tendency to increase in abundance from fall through mid-winter, then decrease into spring. Raptors did not show a clear seasonal fluctuation in mean abundance.

Salamanders also showed a seasonal high, many being observed during the wet fall and winter months (December through January). Lizards showed a trend of increasing abundance from spring into summer. Had surveys been conducted in June and July it is likely that lizard abundance would have remained high through the summer months. Snakes did not show a strong seasonal peak in abundance. This is partly due to the low numbers of individual snakes observed.

The primary mammalian species observed was the California ground squirrel. The highest abundance of this species occurred in the fall (September) and again in the winter (January).

Butterflies appeared to be highly seasonal as well, with mean abundance being highest in the summer months (August and September). There seems to be a clear trend toward increasing butterfly abundance from the spring into summer, then decreasing into fall. This corresponds with the growing season, when the plants on which these species rely are growing and in bloom.

TIDAL STAGE

Analysis of bird use by tidal stage (i.e., high tide and low tide) was somewhat difficult, because the survey schedule was not designed to correspond with specific tidal stages, but was pre-determined based on other factors (e.g., to coordinate the bird surveys with other program activities). Therefore, only two tidal stages were defined for purposes of the analysis: incoming and outgoing. However, not every month had a survey during both an incoming and outgoing tide. Figures 27-28 (Appendix C) show waterfowl and shorebird abundance, respectively, in the aquatic habitats by tidal stage. The Cove, South Basin, and Outer Basin were important habitat areas for waterfowl, and in general there was not a marked difference in mean abundance between tidal stages. Yosemite Slough, which is the smallest water area surveyed and experiences the greatest tidal fluctuation, was not an important waterfowl area.

Unlike waterfowl, shorebirds were most abundant in Yosemite Slough, where tidal fluctuations expose foraging areas on the mudflats. There was a marked increase in the mean number of shorebirds using Yosemite Slough on the outgoing tidal stage during the fall and winter periods.

Shorebird use of the South Basin, Outer Basin, and Cove was more limited compared to Yosemite Slough, probably because these areas have less exposed mudflat during low tides. Peaks in the mean number of shorebirds using the Outer Basin and Cove reflect foraging on the rocky shores or beach of these areas or roosting on the shoreline during high tides, although there doesn't seem to be a clear pattern related to incoming or outgoing tide. Yosemite Slough is not a good shorebird roost site as most shorebirds require an unobstructed view of approaching predators which is limited by the greater amount of shoreline vegetation in Yosemite Slough.

RELATIVE ABUNDANCE

Figures 29-A and 29-B (1-5) (Appendix C) show the relative abundance of the bird species that made up at least 2 percent of the total observations for each area. Across the study area, the species with the highest relative abundance was ruddy duck. Large numbers of ruddy ducks used the Cove and South Basin. Shorebirds dominated Yosemite Slough, with least sandpiper and western sandpiper having the highest relative abundance in this sub-area. The primarily open-water sub-areas (excluding Yosemite Slough) were dominated by waterfowl such as ruddy ducks and scaup as well as gulls and cormorants. Double-crested cormorant was the species with the highest relative abundance in the Outer Basin, as this species roosts in large numbers on the piers on the north side of this area.

Upland areas were primarily dominated by common passerines that are typically commensal with humans and tolerant of disturbance. European starlings (a non-native species) and house finches were the species with the highest relative abundance in the upland areas, with rock doves (a non-native species) and white-crowned sparrows also relatively abundant. The large paved parking lot was used heavily by gulls and killdeer. Western gulls had the highest relative abundance in this sub-area, followed by killdeer and California gulls.

UNUSUAL OBSERVATIONS

A number of species observed during the surveys were considered unusual for this location or for the types of habitats present within the study area. Unusual observations are discussed below.

Birds. The wildlife surveys documented a substantial number of bird species that are unusual or uncommon along the Central Bay shoreline. Uncommon waterbirds included red-throated loon, red-necked grebe, white-winged scoter, black oystercatcher, solitary sandpiper, wandering tattler, and spotted sandpiper. Although black oystercatchers nest only in small numbers in San Francisco Bay, it appears they may nest in the study area. Oystercatchers were observed on numerous surveys during both the breeding and non-breeding seasons, and they were often seen on Double Rock, a small island in the South Basin that appears suitable as nesting habitat for this species. The other unusual species noted above do not breed in San Francisco Bay, and were present only as migrants or winter visitors.

Unusual landbird observations (for this part of the bay) included Vaux's swift, Say's phoebe, ash-throated flycatcher, western kingbird, bank swallow, white-breasted nuthatch, hermit thrush, orange-crowned warbler, Wilson's warbler, yellow warbler, western tanager, and chipping sparrow. Most (or all) of these species were probably migrants or accidental visitors, rather than summer or winter residents in the study area. Another landbird observed, the common yellowthroat, was notable in the

study area, due to the small extent of appropriate habitat for this species (dense brushy or marshy habitats, usually associated with vegetated wetlands).

Reptiles. Although the site is isolated and surrounded by urban and industrial development, three species of snakes find suitable habitat within the study area. The vacant lots and undeveloped, ruderal lands provide cover and foraging habitat for these species. Although natural open spaces are not contiguous with the study area, the undeveloped and underdeveloped lots provide a refuge where these species can survive within the urban setting. Debris discarded on the vacant lots actually provides cover for these species. Ring-necked snakes feed primarily on slender salamanders, the only amphibian observed on the site. The seasonally moist conditions in the ruderal but largely undisturbed uplands support both the ring-necked snakes and their prey. Gopher snakes feed on small mammals including house mice, rats, gophers, ground squirrels, jackrabbits, birds, and lizards. All of these prey items are available in the study area, particularly those portions of the site that are undeveloped. Garter snakes, too, find suitable habitat in the undeveloped portions of the study site. This species will eat a variety of prey that are common on the site including snails, slugs, salamanders, fish, lizards, and small mammals.

Mammals. Harbor seals were observed in the Outer Basin and may occasionally haul out on the more isolated beaches or rocks within the study area, although there do not appear to be any regularly used haul-outs in the study area. The Outer Basin, South Basin, and Cove provide suitable foraging habitat for this species.

OTHER SPECIES OBSERVED

A few species were observed within the study area, but not during one of the scheduled surveys, and therefore were not included in the official results of the wildlife survey. Although these observations are not part of the official survey results, these species may be found onsite in the future.

As noted above, LSA observed 10 California sea lions in the Outer Basin on May 3, 2003. In addition, a local birder, Alan Hopkins, has compiled a list of species that he has observed at the Candlestick Point State Recreation Area over the past 20 years. This list includes 36 bird species that were not observed during this survey. Species that were observed by Mr. Hopkins in the past but not observed during the current survey are listed below:

Common Name	Scientific Name
Common Loon	*Gavia immer*
Harlequin Duck	*Histrionicus histrionicus*
Long-tailed Duck	*Clangula hyemalis*
Barrow's Goldeneye	*Bucephala islandica*
Osprey	*Pandion haliaetus*
Northern Harrier	*Circus cyaneus*
Sharp-shinned Hawk	*Accipiter striatus*
American Peregrine Falcon	*Falco peregrinus anatum*

Common Name	Scientific Name
Black-necked Stilt	*Himantopus mexicanus*
Thayer's Gull	*Larus thayeri*
Burrowing Owl	*Athene cunicularia*
Short-eared Owl	*Asio flammeus*
White-throated Swift	*Aeronautes saxatalis*
Allen's Hummingbird	*Selasphorus sasin*
Tropical Kingbird	*Tyrannus melancholicus*
Horned Lark	*Eremophila alpestris*
Tree Swallow	*Tachycineta bicolor*
Violet-green Swallow	*Tachycineta thalassina*
Cliff Swallow	*Petrochelidon pyrrhonota*
Oak Titmouse	*Baeolophus inornatus*
Rock Wren	*Salpinctes obsoletus*
Golden-crowned Kinglet	*Regulus satrapa*
Blue-gray Gnatcatcher	*Polioptila caerulea*
Loggerhead Shrike	*Lanius ludovicianus*
Hutton's Vireo	*Vireo huttoni*
Townsend's Warbler	*Dendroica townsendi*
Palm Warbler	*Dendroica palmarum*
Clay-colored Sparrow	*Spizella pallida*
Lark Sparrow	*Chondestes grammacus*
Lincoln's Sparrow	*Melospiza lincolnii*
White-throated Sparrow	*Zonotrichia albicollis*
Dark-eyed Junco	*Junco hyemalis*
Bobolink	*Dolichonyx oryzivorus*
Tricolored Blackbird	*Agelaius tricolor*
Baltimore Oriole	*Icterus galbula*
Pine Siskin	*Carduelis pinus*

RECOMMENDATIONS

Although the primary goal of the wildlife survey was to document the species of birds, mammals, reptiles, amphibians, and butterflies that occur in the study area, we have included a number of recommendations for managing and improving the wildlife habitat of the site. These recommendations may require additional study and planning in order to implement them successfully.

- Enhancement and expansion of tidal mudflats and salt marsh would increase the number of shorebirds that occur on the site. Expansion of the marsh on the north side of Yosemite Slough would provide additional foraging habitat and cover for waterbirds. However, expansion of salt marsh habitat would likely result in a reduction of terrestrial habitat.

- Disturbance of the open water habitats of the South Basin, Outer Basin, and Cove should be minimized and avoided to the extent possible. These open water habitats provide loafing areas and foraging habitat for large numbers of waterfowl and other waterbirds. Development in the open water habitats would reduce their value to waterfowl, other waterbirds, and marine mammals (e.g., harbor seals and sea lions).

- Pilings, piers, and docks in the South Basin and Outer Basin should be preserved whenever possible to provide roost sites for species such as cormorants, shorebirds, pelicans, and terns.

- Large parcels of relatively undisturbed and undeveloped terrestrial habitat (e.g., Rock Garden, Upland 1, and Upland 2) should be preserved within the study area to provide habitat for landbirds, small mammals, reptiles, amphibians, and butterflies. Intensive landscaping and recreational use would reduce the value of these areas to native wildlife. Trails through the undeveloped parcels may help minimize the disturbance to the sites that would otherwise result from multiple informal trails.

- Although the parking lots are used by some native wildlife such as gulls, the diversity of species in these areas is typically low compared to the other sub-areas of the study area (e.g., Park, Uplands). Conversion of undeveloped parcels to additional parking would further reduce the amount of habitat available for landbirds as well as small mammals, reptiles, amphibians, and butterflies.

- Increasing the vegetative cover on the undeveloped parcels, combined with varying topography, would improve habitat values and encourage additional wildlife use of these terrestrial sites. Providing rock piles and brush piles would provide habitat for snakes, lizards, and small mammals. Rock piles may also provide habitat for burrowing owls, which have been reported from the area in the past, but which were not observed during the current survey. Increased populations of prey such as mice and lizards would also provide prey for raptors and carnivores. It would be particularly important to provide additional cover on the undeveloped parcels if debris and trash is removed, as this material currently provides cover for wildlife.

- Undeveloped parcels should be planted with native vegetation appropriate for the San Francisco Bay shoreline. Native flowering plants would provide improved habitat for butterflies as well as native birds, mammals, reptiles, and amphibians. Planting trees and shrubs would provide additional perching and nesting sites for landbirds.

CONCLUSIONS

The Yosemite Slough study area provides valuable wildlife habitat for native birds, mammals, reptiles, amphibians, and butterflies within and adjacent to the urban environment of San Francisco. Although the study area is highly disturbed, its open water and shoreline habitats, undeveloped fields, and parks support a great variety of waterbirds and landbirds, and a surprising number of reptile species. The small salt marsh along the shoreline of Yosemite Slough provides foraging habitat for many shorebirds, while the large open water areas (the South Basin, Outer Basin, and Cove) provide loafing and foraging areas for large numbers of waterfowl and other waterbirds, as well as marine mammals. Upland areas including the park, rock garden and parking lot provide habitat for numerous landbirds, as well as gulls and killdeer.

Given the considerable diversity and abundance of wildlife present within the study area – even though its habitats have been greatly degraded by human activities – it is clear that habitat restoration projects would quickly increase the area's wildlife populations. Many species are already using this area, and they would quickly move into new and improved habitats, both within the study area and at adjacent sites. Habitat restoration projects would thus provide better opportunities for the local community to experience the native wildlife that once dominated the shoreline and adjacent waters of Yosemite Slough.

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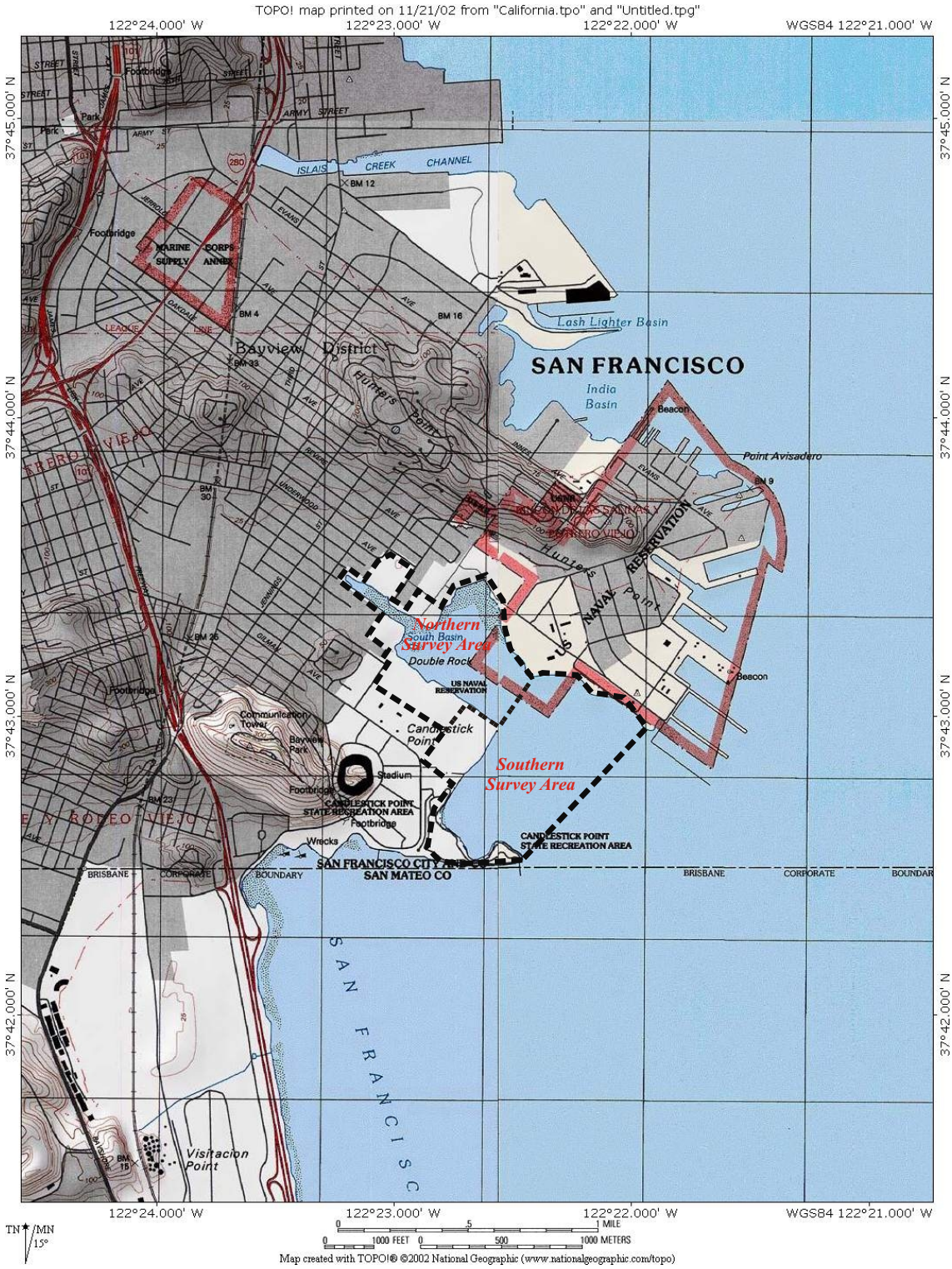
APPENDIX A

MAPS



LSA

LEGEND

STUDY AREA BOUNDARY

MAP 1

Yosemite Slough Watershed Wildlife Surveys
San Francisco, California

Yosemite Slough Study Area

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MAP 2

Yosemite Slough Watershed Wildlife Surveys

Yosemite Slough Study Area - Regions and Landmarks

Legend

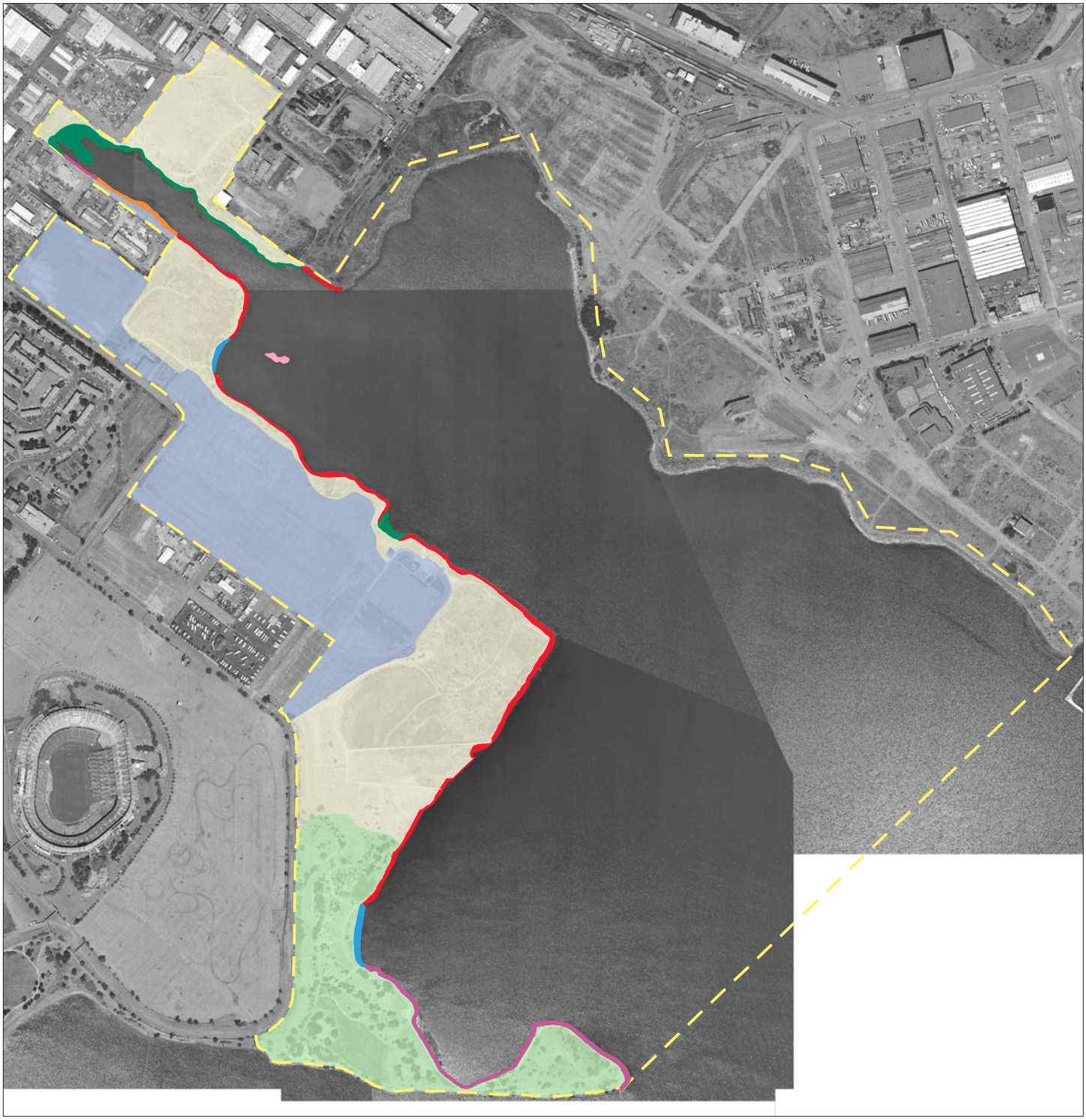
Study Area Boundary

Limit of Sub-region

N

LSA

7/14/04 (P:\GGA230\g\study_area aerial2b.cdr)



LSA

Project Boundary

Sandy Beach
Mud Shoreline
Cobble / Rubble Shoreline
Riprap
Salt Marsh
Rocks
Ruderal Grassland
Urban / Parking Lot
Urban - Landscaped Park

N

0.1 0.05 0 0.1
MILES

MAP 3

Yosemite Slough Watershed
Wildlife Surveys
Habitats and Shoreline Substrates.

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APPENDIX B

TABLES

Table 1. Species Diversity by Year and Taxon/Guild.†

	Number of Species Observed	
Taxonomic Group/Guild	**2003**	**2004**
Birds	**118**	**83**
Gulls & Terns	9	6
Shorebirds	21	16
Waterfowl	12	8
Other Waterbirds	19	15
Landbirds	49	32
Raptors & Owls	8	6
Amphibians	**1**	**1**
Salamanders	1	1
Reptiles	**5**	**2**
Lizards	2	1
Snakes	3	1
Mammals	**10**	**4**
Carnivores	4	1
Pinnepeds	1	1
Lagomorphs	1	1
Rodents	4	1
Butterflies	**14**	**5**

†Not including unidentified species that overlap with identified species (e.g., "gull species overlaps with "western gull").

Table 2. Maximum Number of Individuals Observed in a Single Survey in All Sub-Areas, Yosemite Slough Study Area, San Francisco, CA. January 2003 through April 2004.

Common Name	Scientific Name	Maximum Number of Individuals Observed
BIRDS		
Gulls & Terns		
Gull sp.	*Larus sp.*	225
Mew Gull	*Larus canus*	51
Ring-billed Gull	*Larus delawarensis*	9
California Gull	*Larus californicus*	563
Herring Gull	*Larus argentatus*	11
Western Gull	*Larus occidentalis*	622
Glaucous-winged Gull	*Larus glaucescens*	22
Caspian Tern	*Sterna caspia*	6
Elegant Tern	*Sterna elegans*	19
Forster's Tern	*Sterna forsteri*	11
Shorebirds		
Black-bellied Plover	*Pluvialis squatarola*	46
Semipalmated Plover	*Charadrius semipalmatus*	28
Killdeer	*Charadrius vociferus*	127
Black Oystercatcher	*Haematopus bachmani*	12
American Avocet	*Recurvirostra americana*	35
Greater Yellowlegs	*Tringa melanoleuca*	2
Solitary Sandpiper	*Tringa solitaria*	1
Willet	*Catoptrophorus semipalmatus*	69
Wandering Tattler	*Heteroscelus incanus*	1
Spotted Sandpiper	*Actitis macularia*	16
Long-billed Curlew	*Numenius americanus*	1
Whimbrel	*Numenius phaeopus*	12
Marbled Godwit	*Limosa fedoa*	4
Ruddy Turnstone	*Arenaria interpres*	50
Black Turnstone	*Arenaria melanocephala*	1
Calidris sp.	*Calidris sp.*	541
Sanderling	*Calidris alba*	21
Western Sandpiper	*Calidris mauri*	358
Least Sandpiper	*Calidris minutilla*	245
Dunlin	*Calidris alpina*	194
Dowitcher sp.	*Limnodromus sp.*	35
Red-necked Phalarope	*Phalaropus lobatus*	1
Waterfowl		
Canada Goose	*Branta canadensis*	96
Duck sp.		50
American Wigeon	*Anas americana*	2
Mallard	*Anas platyrhynchos*	5
Canvasback	*Aythya valisineria*	5

Table 2. Maximum Number of Individuals Observed in a Single Survey in All Sub-Areas, Yosemite Slough Study Area, San Francisco, CA. January 2003 through April 2004.

Common Name	Scientific Name	Maximum Number of Individuals Observed
Scaup sp.	*Aythya sp.*	142
Greater Scaup	*Aythya marila*	646
Lesser Scaup	*Aythya affinis*	90
Surf Scoter	*Melanitta perspicillata*	267
White-winged Scoter	*Melanitta fusca*	1
Bufflehead	*Bucephala albeola*	183
Common Goldeneye	*Bucephala clangula*	16
Red-breasted Merganser	*Mergus serrator*	5
Ruddy Duck	*Oxyura jamaicensis*	510
Other Waterbirds		
Red-throated Loon	*Gavia stellata*	3
Pied-billed Grebe	*Podilymbus podiceps*	1
Aechmophorus sp.	*Aechmophorus sp.*	48
Western Grebe	*Aechmophorus occidentalis*	115
Clark's Grebe	*Aechmophorus clarkii*	103
Common Loon	*Gavia immer*	3
Podiceps sp.	*Podiceps sp.*	3
Horned Grebe	*Podiceps auritus*	17
Red-necked Grebe	*Podiceps grisegena*	1
Eared Grebe	*Podiceps nigricollis*	12
Brown Pelican	*Pelecanus occidentalis*	36
Cormorant sp.	*Phalacrocorax sp.*	160
Brandt's Cormorant	*Phalacrocorax penicillatus*	2
Double-crested Cormorant	*Phalacrocorax auritus*	747
Pelagic Cormorant	*Phalacrocorax pelagicus*	2
Great Blue Heron	*Ardea herodias*	2
Great Egret	*Ardea alba*	10
Snowy Egret	*Egretta thula*	12
Black-crowned Night-Heron	*Nycticorax nycticorax*	2
American Coot	*Fulica americana*	6
Belted Kingfisher	*Ceryle alcyon*	1
Landbirds		
Rock Dove	*Columba livia*	85
Mourning Dove	*Zenaida macroura*	21
Vaux's Swift	*Chaetura vauxi*	2
Anna's Hummingbird	*Calypte anna*	20
Rufous Hummingbird	*Selasphorus rufus*	1
Downy Woodpecker	*Picoides pubescens*	1
Northern Flicker	*Colaptes auratus*	2
Black Phoebe	*Sayornis nigricans*	6
Say's Phoebe	*Sayornis saya*	7
Ash-throated Flycatcher	*Myiarchus cinerascens*	5

Table 2. Maximum Number of Individuals Observed in a Single Survey in All Sub-Areas, Yosemite Slough Study Area, San Francisco, CA. January 2003 through April 2004.

Common Name	Scientific Name	Maximum Number of Individuals Observed
Western Kingbird	*Tyrannus verticalis*	2
Western Scrub-jay	*Aphelocoma californica*	4
American Crow	*Corvus brachyrhynchos*	24
Common Raven	*Corvus corax*	68
Northern Rough-winged Swallow	*Stelgidopteryx serripennis*	1
Bank Swallow	*Riparia riparia*	2
Barn Swallow	*Hirundo rustica*	5
Chestnut-backed Chickadee	*Poecile rufescens*	6
Bushtit	*Psaltriparus minimus*	41
White-breasted Nuthatch	*Sitta carolinensis*	1
Ruby-crowned Kinglet	*Regulus calendula*	8
Hermit Thrush	*Catharus guttatus*	1
American Robin	*Turdus migratorius*	30
Northern Mockingbird	*Mimus polyglottos*	9
European Starling	*Sturnus vulgaris*	247
American Pipit	*Anthus rubescens*	2
Orange-crowned Warbler	*Vermivora celata*	1
Yellow Warbler	*Dendroica petechia*	3
Yellow-rumped Warbler	*Dendroica coronata*	45
Common Yellowthroat	*Geothlypis trichas*	2
Wilson's Warbler	*Wilsonia pusilla*	1
Western Tanager	*Piranga ludoviciana*	2
Spotted Towhee	*Pipilo maculatus*	2
California Towhee	*Pipilo fuscus*	15
Sparrow sp.		15
Chipping Sparrow	*Spizella passerina*	2
Savannah Sparrow	*Passerculus sandwichensis*	7
Fox Sparrow	*Passerella iliaca*	6
Song Sparrow	*Melospiza melodia*	8
Zonotrichia sp.	*Zonotrichia sp.*	57
Lincoln's Sparrow	*Melospiza lincolnii*	2
White-crowned Sparrow	*Zonotrichia leucophrys*	175
Golden-crowned Sparrow	*Zonotrichia atricapilla*	62
Red-winged Blackbird	*Agelaius phoeniceus*	86
Western Meadowlark	*Sturnella neglecta*	146
Brewer's Blackbird	*Euphagus cyanocephalus*	49
Brown-headed Cowbird	*Molothrus ater*	19
House Finch	*Carpodacus mexicanus*	143
Lesser Goldfinch	*Carduelis psaltria*	10
American Goldfinch	*Carduelis tristis*	38
House Sparrow	*Passer domesticus*	23

Table 2. Maximum Number of Individuals Observed in a Single Survey in All Sub-Areas, Yosemite Slough Study Area, San Francisco, CA. January 2003 through April 2004.

Common Name	Scientific Name	Maximum Number of Individuals Observed
Raptors		
Turkey Vulture	*Cathartes aura*	1
White-tailed Kite	*Elanus leucurus*	2
Accipiter sp.	*Accipiter sp.*	2
Sharp-shinned Hawk	*Accipiter striatus*	1
Cooper's Hawk	*Accipiter cooperii*	2
Red-shouldered Hawk	*Buteo lineatus*	1
Red-tailed Hawk	*Buteo jamaicensis*	8
American Kestrel	*Falco sparverius*	2
Merlin	*Falco columbarius*	1
AMPHIBIANS		
California Slender Salamander	*Batrachoseps attenuatus*	43
REPTILES		
Lizard sp.		5
Southern Alligator Lizard	*Elgaria multicarinata*	22
Western Fence Lizard	*Sceloporus occidentalis*	49
Gopher Snake	*Pituophis melanoleucus*	2
Ring-necked Snake	*Diadophis punctatus*	3
Western Garter Snake	*Thamnophis elegans*	1
MAMMALS		
Feral Domestic Cat	*Felis silvestris*	2
Feral Domestic Dog	*Canis familiaris*	2
Raccoon	*Procyon lotor*	5
Striped Skunk	*Mephitis mephitis*	1
Harbor Seal	*Phoca vitulina*	9
Black-tailed Jackrabbit	*Lepus californicus*	6
Botta's Pocket Gopher	*Thomomys bottae*	1
California Ground Squirrel	*Spermophilus beecheyi*	143
California Vole	*Microtus californicus*	1
Norway Rat	*Rattus norvegicus*	1
BUTTERFLIES		
Butterfly sp.		38
Swallowtail sp.	*Papilio sp.*	7
Anise Swallowtail	*Papilio zelicaon*	27
Cabbage White	*Pieris rapae*	64
Mustard White	*Pieris napi*	1
Orange Sulphur	*Colias eurytheme*	1
California Hairstreak	*Satyrium californicum*	2
Gray Hairstreak	*Strymon melinus*	2

Table 2. Maximum Number of Individuals Observed in a Single Survey in All Sub-Areas, Yosemite Slough Study Area, San Francisco, CA. January 2003 through April 2004.

Common Name	Scientific Name	Maximum Number of Individuals Observed
Blue sp.		1
Western Pygmy-Blue	*Brephidium exile*	1
Spring Azure	*Celastrina ladon*	2
West Coast Lady	*Vanessa annabella*	7
Red Admiral	*Vanessa atalanta*	4
Common Buckeye	*Junonia coenia*	9
Common Ringlet	*Coenonympha tullia*	1
Monarch	*Danaus plexippus*	7
Skipper sp.		3
Common Checkered Skipper	*Pyrgus communis*	22

Table 3. Mean Abundance of Species Observed at the Yosemite Slough Study Area, January 2003 through April 2004. San Francisco, CA

		Mean Abundance										
Common Name	**Scientific Name**	**All Areas**	**Cove**	**Outer Basin**	**Park**	**Parking Lot**	**Rock Garden**	**South Basin**	**Upland 1**	**Upland 2**	**Upland 3**	**Yosemite Slough**
BIRDS												
Gulls & Terns												
Gull sp.	*Larus sp.*	32.45	0.93	18.72	0.86	0.00	0.00	11.93	0.00	0.00	0.00	0.00
Mew Gull	*Larus canus*	4.59	0.38	0.00	0.00	0.00	0.00	3.76	0.00	0.00	0.00	0.45
Ring-billed Gull	*Larus delawarensis*	0.69	0.00	0.00	0.00	0.00	0.00	0.41	0.00	0.00	0.00	0.28
California Gull	*Larus californicus*	116.93	27.48	11.97	0.00	8.38	0.00	55.45	0.00	0.00	0.00	13.66
Herring Gull	*Larus argentatus*	0.45	0.00	0.07	0.00	0.00	0.00	0.38	0.00	0.00	0.00	0.00
Western Gull	*Larus occidentalis*	98.93	8.10	42.93	0.00	18.79	0.00	28.10	0.00	0.00	0.00	1.00
Glaucous-winged Gull	*Larus glaucescens*	1.62	0.28	0.79	0.00	0.10	0.00	0.45	0.00	0.00	0.00	0.00
Caspian Tern	*Sterna caspia*	0.41	0.17	0.14	0.00	0.00	0.00	0.10	0.00	0.00	0.00	0.00
Elegant Tern	*Sterna elegans*	0.66	0.00	0.00	0.00	0.00	0.00	0.66	0.00	0.00	0.00	0.00
Forster's Tern	*Sterna forsteri*	1.41	0.28	0.48	0.00	0.00	0.00	0.66	0.00	0.00	0.00	0.00
Shorebirds												
Black-bellied Plover	*Pluvialis squatarola*	14.55	3.17	0.59	0.03	0.00	0.00	5.24	0.00	0.00	0.14	5.38
Semipalmated Plover	*Charadrius semipalmatus*	4.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.03
Killdeer	*Charadrius vociferus*	23.72	0.17	0.10	0.00	15.45	0.00	0.72	2.17	1.83	0.00	3.28
Black Oystercatcher	*Haematopus bachmani*	1.86	0.21	0.17	0.00	0.00	0.00	1.34	0.00	0.00	0.00	0.14
American Avocet	*Recurvirostra americana*	5.07	0.03	0.00	0.00	0.00	0.00	2.93	0.00	0.00	0.31	1.79
Greater Yellowlegs	*Tringa melanoleuca*	0.34	0.10	0.00	0.00	0.00	0.00	0.10	0.00	0.00	0.00	0.14
Solitary Sandpiper	*Tringa solitaria*	0.03	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Willet	*Catoptrophorus semipalmatus*	18.55	1.41	0.59	0.00	0.00	0.00	7.00	0.00	0.00	0.62	8.93
Wandering Tattler	*Heteroscelus incanus*	0.03	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00
Spotted Sandpiper	*Actitis macularia*	5.79	3.03	1.03	0.00	0.00	0.00	1.41	0.00	0.00	0.00	0.31
Long-billed Curlew	*Numenius americanus*	0.21	0.03	0.00	0.00	0.00	0.00	0.07	0.00	0.00	0.00	0.10
Whimbrel	*Numenius phaeopus*	3.79	0.55	0.21	0.00	0.00	0.00	2.03	0.00	0.00	0.03	0.97
Marbled Godwit	*Limosa fedoa*	0.17	0.00	0.00	0.00	0.00	0.00	0.17	0.00	0.00	0.00	0.00
Ruddy Turnstone	*Arenaria interpres*	1.83	0.03	0.03	0.00	0.00	0.00	1.76	0.00	0.00	0.00	0.00
Black Turnstone	*Arenaria melanocephala*	0.10	0.03	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.03
Calidris sp.	*Calidris sp.*	27.03	3.17	1.48	0.00	0.00	0.00	15.48	0.00	0.00	0.00	6.90
Sanderling	*Calidris alba*	1.52	0.97	0.00	0.00	0.00	0.00	0.55	0.00	0.00	0.00	0.00
Western Sandpiper	*Calidris mauri*	34.93	4.17	9.03	0.00	0.00	0.00	5.00	0.00	0.00	0.00	16.72
Least Sandpiper	*Calidris minutilla*	57.83	7.14	1.03	0.00	0.00	0.00	13.52	0.00	0.00	1.38	34.76
Dunlin	*Calidris alpina*	14.45	4.07	0.03	0.00	0.00	0.00	1.83	0.00	0.00	0.00	8.52
Dowitcher sp.	*Limnodromus sp.*	2.03	0.07	0.00	0.00	0.00	0.00	1.93	0.00	0.00	0.00	0.03
Red-necked Phalarope	*Phalaropus lobatus*	0.03	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00
Waterfowl												
Canada Goose	*Branta canadensis*	8.83	0.03	0.55	0.14	0.07	0.00	4.66	0.00	0.07	0.00	3.31
Duck sp.		3.59	0.03	3.55	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
American Wigeon	*Anas americana*	0.10	0.03	0.00	0.00	0.00	0.00	0.07	0.00	0.00	0.00	0.00
Mallard	*Anas platyrhynchos*	0.86	0.21	0.00	0.00	0.00	0.00	0.55	0.00	0.00	0.00	0.10
Canvasback	*Aythya valisineria*	0.41	0.00	0.00	0.00	0.00	0.00	0.38	0.00	0.00	0.00	0.03
Scaup sp.	*Aythya sp.*	11.17	1.90	3.24	0.00	0.00	0.00	6.03	0.00	0.00	0.00	0.00
Greater Scaup	*Aythya marila*	106.14	40.07	11.97	0.00	0.00	0.00	53.66	0.00	0.00	0.00	0.45
Lesser Scaup	*Aythya affinis*	12.86	3.34	3.38	0.00	0.00	0.00	5.55	0.00	0.00	0.00	0.59
Surf Scoter	*Melanitta perspicillata*	41.79	8.07	22.14	0.00	0.00	0.00	11.48	0.00	0.00	0.00	0.10
White-winged Scoter	*Melanitta fusca*	0.07	0.00	0.00	0.00	0.00	0.00	0.07	0.00	0.00	0.00	0.00
Bufflehead	*Bucephala albeola*	50.76	9.41	17.24	0.00	0.00	0.00	23.97	0.00	0.00	0.00	0.14
Common Goldeneye	*Bucephala clangula*	4.03	1.10	0.76	0.00	0.00	0.00	1.90	0.00	0.00	0.00	0.28

Table 3. Mean Abundance of Species Observed at the Yosemite Slough Study Area, January 2003 through April 2004. San Francisco, CA

		Mean Abundance										
Common Name	**Scientific Name**	**All Areas**	**Cove**	**Outer Basin**	**Park**	**Parking Lot**	**Rock Garden**	**South Basin**	**Upland 1**	**Upland 2**	**Upland 3**	**Yosemite Slough**
Red-breasted Merganser	*Mergus serrator*	0.83	0.48	0.17	0.00	0.00	0.00	0.17	0.00	0.00	0.00	0.00
Ruddy Duck	*Oxyura jamaicensis*	180.55	89.69	15.24	0.00	0.00	0.00	75.41	0.00	0.00	0.00	0.21
Other Waterbirds												
Red-throated Loon	*Gavia stellata*	0.28	0.14	0.10	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00
Pied-billed Grebe	*Podilymbus podiceps*	0.10	0.00	0.07	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00
Aechmophorus sp.	*Aechmophorus sp.*	4.00	1.59	2.24	0.00	0.00	0.00	0.17	0.00	0.00	0.00	0.00
Western Grebe	*Aechmophorus occidentalis*	17.10	4.41	7.66	0.00	0.00	0.00	4.97	0.00	0.00	0.00	0.07
Clark's Grebe	*Aechmophorus clarkii*	17.79	3.48	9.28	0.00	0.00	0.00	4.83	0.00	0.00	0.00	0.21
Common Loon	*Gavia immer*	0.48	0.14	0.31	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00
Podiceps sp.	*Podiceps sp.*	0.10	0.00	0.00	0.00	0.00	0.00	0.10	0.00	0.00	0.00	0.00
Horned Grebe	*Podiceps auritus*	4.66	1.31	1.72	0.00	0.00	0.00	1.31	0.00	0.00	0.00	0.31
Red-necked Grebe	*Podiceps grisegena*	0.07	0.03	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00
Eared Grebe	*Podiceps nigricollis*	2.86	0.52	0.55	0.00	0.00	0.00	1.38	0.00	0.00	0.00	0.41
Brown Pelican	*Pelecanus occidentalis*	6.90	2.10	2.86	1.21	0.00	0.21	0.52	0.00	0.00	0.00	0.00
Cormorant sp.	*Phalacrocorax sp.*	8.66	0.00	8.66	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Brandt's Cormorant	*Phalacrocorax penicillatus*	0.14	0.03	0.00	0.00	0.00	0.00	0.10	0.00	0.00	0.00	0.00
Double-crested Cormorant	*Phalacrocorax auritus*	57.17	1.86	51.79	0.00	0.00	0.00	3.41	0.00	0.00	0.00	0.10
Pelagic Cormorant	*Phalacrocorax pelagicus*	0.17	0.10	0.03	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00
Great Blue Heron	*Ardea herodias*	0.38	0.00	0.10	0.03	0.00	0.07	0.17	0.00	0.00	0.00	0.00
Great Egret	*Ardea alba*	1.10	0.10	0.10	0.00	0.00	0.00	0.76	0.00	0.00	0.00	0.14
Snowy Egret	*Egretta thula*	4.38	0.48	0.31	0.00	0.00	0.00	2.86	0.00	0.00	0.00	0.72
Black-crowned Night-Heron	*Nycticorax nycticorax*	0.07	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
American Coot	*Fulica americana*	0.31	0.10	0.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Belted Kingfisher	*Ceryle alcyon*	0.14	0.07	0.03	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00
Landbirds												
Rock Dove	*Columba livia*	21.76	0.00	0.00	2.62	0.59	4.41	0.00	6.41	2.59	5.14	0.00
Mourning Dove	*Zenaida macroura*	7.10	0.00	0.00	0.24	0.55	0.59	0.00	2.21	2.48	1.00	0.03
Vaux's Swift	*Chaetura vauxi*	0.07	0.00	0.00	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Anna's Hummingbird	*Calypte anna*	8.03	0.00	0.00	2.24	0.41	1.14	0.00	2.00	1.79	0.41	0.03
Rufous Hummingbird	*Selasphorus rufus*	0.03	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Downy Woodpecker	*Picoides pubescens*	0.03	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Northern Flicker	*Colaptes auratus*	0.31	0.00	0.00	0.17	0.00	0.07	0.00	0.00	0.03	0.03	0.00
Black Phoebe	*Sayornis nigricans*	1.76	0.00	0.00	0.66	0.03	0.14	0.00	0.31	0.38	0.14	0.10
Say's Phoebe	*Sayornis saya*	0.79	0.00	0.00	0.10	0.00	0.10	0.00	0.10	0.41	0.03	0.03
Ash-throated Flycatcher	*Myiarchus cinerascens*	0.17	0.00	0.00	0.14	0.00	0.03	0.00	0.00	0.00	0.00	0.00
Western Kingbird	*Tyrannus verticalis*	0.14	0.00	0.00	0.07	0.00	0.03	0.00	0.00	0.03	0.00	0.00
Western Scrub-jay	*Aphelocoma californica*	1.62	0.00	0.00	0.62	0.10	0.03	0.00	0.28	0.52	0.07	0.00
American Crow	*Corvus brachyrhynchos*	4.41	0.00	0.00	1.38	0.00	0.48	0.00	1.76	0.72	0.03	0.03
Common Raven	*Corvus corax*	24.34	0.00	0.00	9.34	2.21	4.45	0.00	5.07	3.10	0.17	0.00
Northern Rough-winged Swallow	*Stelgidopteryx serripennis*	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00
Bank Swallow	*Riparia riparia*	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.00
Barn Swallow	*Hirundo rustica*	0.76	0.07	0.00	0.10	0.10	0.21	0.03	0.24	0.00	0.00	0.00
Chestnut-backed Chickadee	*Poecile rufescens*	0.62	0.00	0.00	0.34	0.00	0.03	0.00	0.21	0.03	0.00	0.00
Bushtit	*Psaltriparus minimus*	17.55	0.10	0.00	9.21	0.07	2.00	0.00	3.55	2.45	0.17	0.00
White-breasted Nuthatch	*Sitta carolinensis*	0.03	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ruby-crowned Kinglet	*Regulus calendula*	1.10	0.00	0.00	0.66	0.03	0.10	0.00	0.21	0.10	0.00	0.00
Hermit Thrush	*Catharus guttatus*	0.07	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.03
American Robin	*Turdus migratorius*	3.24	0.00	0.00	0.55	0.14	0.03	0.00	2.21	0.14	0.17	0.00
Northern Mockingbird	*Mimus polyglottos*	3.45	0.00	0.00	0.79	0.03	0.79	0.03	0.79	0.52	0.45	0.03

Table 3. Mean Abundance of Species Observed at the Yosemite Slough Study Area, January 2003 through April 2004. San Francisco, CA

		Mean Abundance										
Common Name	**Scientific Name**	**All Areas**	**Cove**	**Outer Basin**	**Park**	**Parking Lot**	**Rock Garden**	**South Basin**	**Upland 1**	**Upland 2**	**Upland 3**	**Yosemite Slough**
European Starling	*Sturnus vulgaris*	56.48	0.17	0.00	20.14	1.45	5.31	0.00	17.24	2.97	9.03	0.17
American Pipit	*Anthus rubescens*	0.14	0.00	0.00	0.00	0.00	0.03	0.00	0.07	0.00	0.00	0.03
Orange-crowned Warbler	*Vermivora celata*	0.07	0.00	0.00	0.03	0.00	0.03	0.00	0.00	0.00	0.00	0.00
Yellow Warbler	*Dendroica petechia*	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.03	0.00	0.00
Yellow-rumped Warbler	*Dendroica coronata*	7.97	0.28	0.00	2.86	0.28	1.31	0.00	1.72	1.28	0.17	0.07
Common Yellowthroat	*Geothlypis trichas*	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.03	0.07	0.00
Wilson's Warbler	*Wilsonia pusilla*	0.03	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00
Western Tanager	*Piranga ludoviciana*	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.00	0.00	0.00
Spotted Towhee	*Pipilo maculatus*	0.14	0.00	0.00	0.07	0.00	0.07	0.00	0.00	0.00	0.00	0.00
California Towhee	*Pipilo fuscus*	5.90	0.10	0.00	2.24	0.17	1.41	0.00	0.86	0.90	0.21	0.00
Sparrow sp.		0.52	0.00	0.00	0.00	0.00	0.00	0.00	0.52	0.00	0.00	0.00
Chipping Sparrow	*Spizella passerina*	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.00	0.00	0.00
Savannah Sparrow	*Passerculus sandwichensis*	1.59	0.07	0.00	0.28	0.07	0.66	0.00	0.31	0.21	0.00	0.00
Fox Sparrow	*Passerella iliaca*	0.69	0.03	0.00	0.14	0.00	0.31	0.00	0.10	0.07	0.03	0.00
Song Sparrow	*Melospiza melodia*	0.79	0.00	0.00	0.07	0.17	0.07	0.00	0.17	0.21	0.10	0.00
Zonotrichia sp.	*Zonotrichia sp.*	8.07	0.00	0.00	2.10	0.00	0.79	0.00	1.48	3.17	0.52	0.00
Lincoln's Sparrow	*Melospiza lincolnii*	0.45	0.00	0.00	0.00	0.00	0.07	0.00	0.17	0.17	0.03	0.00
White-crowned Sparrow	*Zonotrichia leucophrys*	45.00	0.24	0.00	15.90	3.28	10.45	0.00	6.38	5.17	3.48	0.10
Golden-crowned Sparrow	*Zonotrichia atricapilla*	18.28	0.03	0.00	8.41	0.34	4.28	0.00	2.76	1.59	0.66	0.21
Red-winged Blackbird	*Agelaius phoeniceus*	13.90	0.69	0.00	1.31	2.28	2.14	0.00	2.45	4.48	0.55	0.00
Western Meadowlark	*Sturnella neglecta*	27.83	0.03	0.00	5.14	1.03	11.00	0.34	6.72	3.41	0.07	0.07
Brewer's Blackbird	*Euphagus cyanocephalus*	7.48	0.00	0.00	3.59	0.10	0.28	0.00	2.28	0.07	1.17	0.00
Brown-headed Cowbird	*Molothrus ater*	1.07	0.03	0.00	0.62	0.03	0.38	0.00	0.00	0.00	0.00	0.00
House Finch	*Carpodacus mexicanus*	45.21	0.21	0.00	9.00	4.62	13.07	0.00	7.83	8.07	2.38	0.03
Lesser Goldfinch	*Carduelis psaltria*	1.14	0.00	0.00	0.17	0.03	0.41	0.00	0.14	0.28	0.10	0.00
American Goldfinch	*Carduelis tristis*	5.55	0.34	0.00	0.00	0.83	2.17	0.00	1.14	1.00	0.07	0.00
House Sparrow	*Passer domesticus*	4.76	0.00	0.00	0.90	0.00	0.14	0.00	0.69	0.66	2.17	0.21
Raptors												
Turkey Vulture	*Cathartes aura*	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00
White-tailed Kite	*Elanus leucurus*	0.14	0.00	0.00	0.00	0.00	0.14	0.00	0.00	0.00	0.00	0.00
Accipiter sp.	*Accipiter sp.*	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.00	0.00	0.00
Sharp-shinned Hawk	*Accipiter striatus*	0.17	0.00	0.00	0.03	0.00	0.03	0.00	0.10	0.00	0.00	0.00
Cooper's Hawk	*Accipiter cooperii*	0.17	0.00	0.00	0.03	0.03	0.00	0.00	0.10	0.00	0.00	0.00
Red-shouldered Hawk	*Buteo lineatus*	0.07	0.00	0.00	0.03	0.00	0.03	0.00	0.00	0.00	0.00	0.00
Red-tailed Hawk	*Buteo jamaicensis*	1.59	0.00	0.00	0.55	0.07	0.07	0.00	0.69	0.17	0.00	0.03
American Kestrel	*Falco sparverius*	0.79	0.00	0.00	0.10	0.00	0.10	0.00	0.45	0.14	0.00	0.00
Merlin	*Falco columbarius*	0.17	0.00	0.00	0.00	0.00	0.07	0.00	0.07	0.03	0.00	0.00
AMPHIBIANS												
California Slender Salamander	*Batrachoseps attenuatus*	5.76	0.00	0.00	0.00	0.03	1.93	0.03	3.03	0.66	0.00	0.07
REPTILES												
Lizard sp.		0.17	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Southern Alligator Lizard	*Elgaria multicarinata*	2.14	0.76	0.00	0.00	0.00	0.00	0.69	0.62	0.00	0.00	0.07
Western Fence Lizard	*Sceloporus occidentalis*	14.00	0.69	0.72	0.86	0.31	3.34	1.48	3.03	2.14	0.41	1.00
Gopher Snake	*Pituophis melanoleucus*	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.00	0.00	0.00
Ring-necked Snake	*Diadophis punctatus*	0.59	0.00	0.00	0.00	0.00	0.03	0.00	0.14	0.28	0.03	0.10
Western Garter Snake	*Thamnophis elegans*	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00

Table 3. Mean Abundance of Species Observed at the Yosemite Slough Study Area, January 2003 through April 2004. San Francisco, CA

		Mean Abundance										
Common Name	**Scientific Name**	**All Areas**	**Cove**	**Outer Basin**	**Park**	**Parking Lot**	**Rock Garden**	**South Basin**	**Upland 1**	**Upland 2**	**Upland 3**	**Yosemite Slough**
MAMMALS												
Feral Domestic Cat	*Felis silvestris*	0.24	0.00	0.00	0.07	0.00	0.03	0.03	0.00	0.10	0.00	0.00
Feral Domestic Dog	*Canis familiaris*	0.21	0.07	0.00	0.00	0.00	0.03	0.03	0.00	0.00	0.00	0.07
Raccoon	*Procyon lotor*	0.21	0.00	0.00	0.03	0.00	0.00	0.00	0.17	0.00	0.00	0.00
Striped Skunk	*Mephitis mephitis*	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03
Harbor Seal	*Phoca vitulina*	1.10	0.03	1.00	0.00	0.00	0.00	0.07	0.00	0.00	0.00	0.00
Black-tailed Jackrabbit	*Lepus californicus*	1.90	0.07	0.03	0.41	0.00	0.17	0.03	0.48	0.55	0.03	0.10
Botta's Pocket Gopher	*Thomomys bottae*	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00
California Ground Squirrel	*Spermophilus beecheyi*	59.79	14.31	0.69	36.45	0.52	3.83	1.34	0.90	1.52	0.07	0.17
California Vole	*Microtus californicus*	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00
Norway Rat	*Rattus norvegicus*	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00
BUTTERFLIES												
Blue sp.		0.03	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Swallowtail sp.	*Papilio sp.*	0.34	0.00	0.00	0.03	0.00	0.03	0.03	0.21	0.03	0.00	0.00
Anise Swallowtail	*Papilio zelicaon*	4.31	0.03	0.10	0.21	0.00	0.69	0.24	1.93	0.66	0.10	0.34
Cabbage White	*Pieris rapae*	13.93	0.59	0.41	2.55	0.55	2.28	0.93	2.52	3.45	0.38	0.28
Mustard White	*Pieris napi*	0.03	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Orange Sulphur	*Colias eurytheme*	0.03	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00
California Hairstreak	*Satyrium californicum*	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.03	0.00	0.03
Gray Hairstreak	*Strymon melinus*	0.10	0.00	0.00	0.00	0.00	0.03	0.03	0.03	0.00	0.00	0.00
Butterfly sp.		2.38	0.21	0.03	1.03	0.03	0.86	0.10	0.03	0.07	0.00	0.00
Western Pygmy-Blue	*Brephidium exile*	0.03	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Spring Azure	*Celastrina ladon*	0.07	0.00	0.00	0.00	0.00	0.00	0.07	0.00	0.00	0.00	0.00
West Coast Lady	*Vanessa annabella*	1.52	0.21	0.10	0.14	0.00	0.10	0.10	0.34	0.41	0.10	0.00
Red Admiral	*Vanessa atalanta*	0.24	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.14	0.00	0.00
Common Buckeye	*Junonia coenia*	0.93	0.00	0.00	0.07	0.07	0.31	0.07	0.10	0.31	0.00	0.00
Common Ringlet	*Coenonympha tullia*	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00
Monarch	*Danaus plexippus*	0.55	0.10	0.00	0.24	0.00	0.00	0.03	0.03	0.07	0.03	0.03
Skipper sp.		0.34	0.00	0.00	0.21	0.00	0.07	0.00	0.00	0.00	0.07	0.00
Common Checkered Skipper	*Pyrgus communis*	1.03	0.07	0.00	0.00	0.10	0.03	0.00	0.14	0.69	0.00	0.00

APPENDIX C

FIGURES

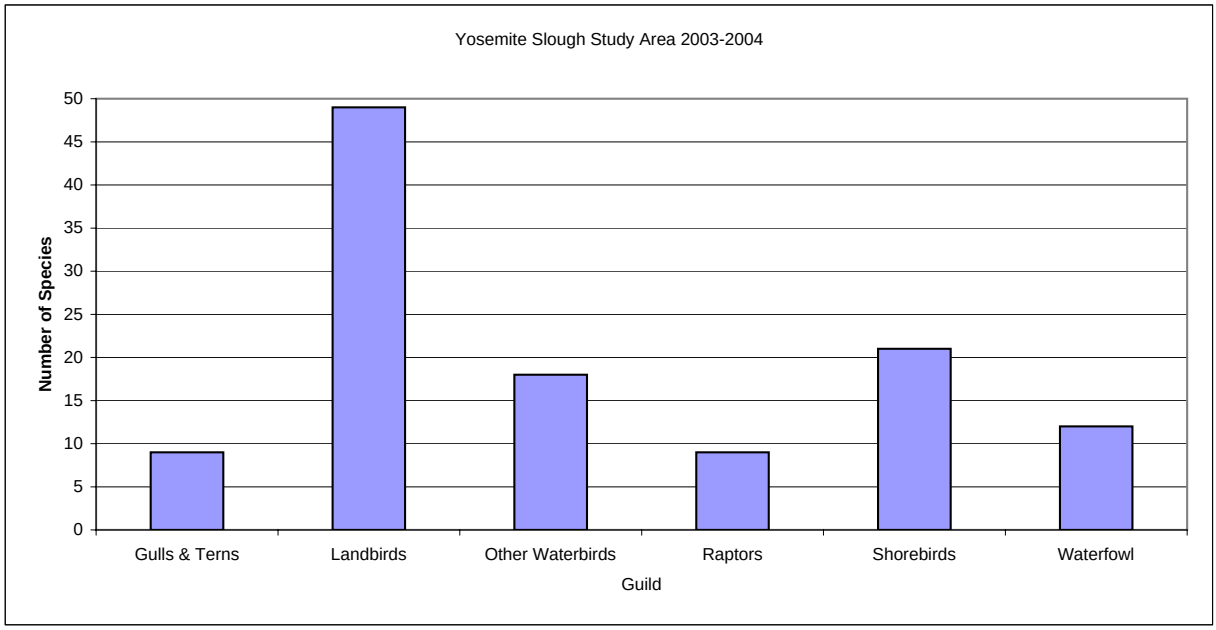


Figure 1. Species Diversity of Birds at Yosemite Slough Study Area, San Francisco, CA (January 2003 - April 2004)

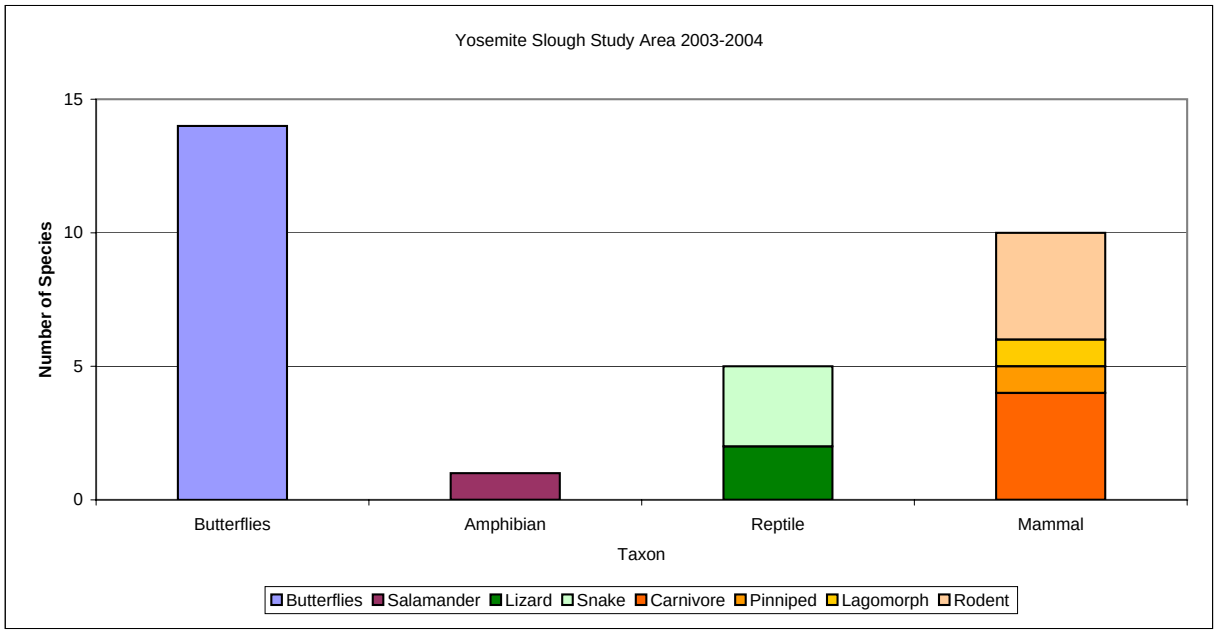


Figure 2. Species Diversity of Butterflies, Amphibians, Reptiles, and Mammals at Yosemite Slough Study Area, San Francisco, CA (January 2003 - April 2004)

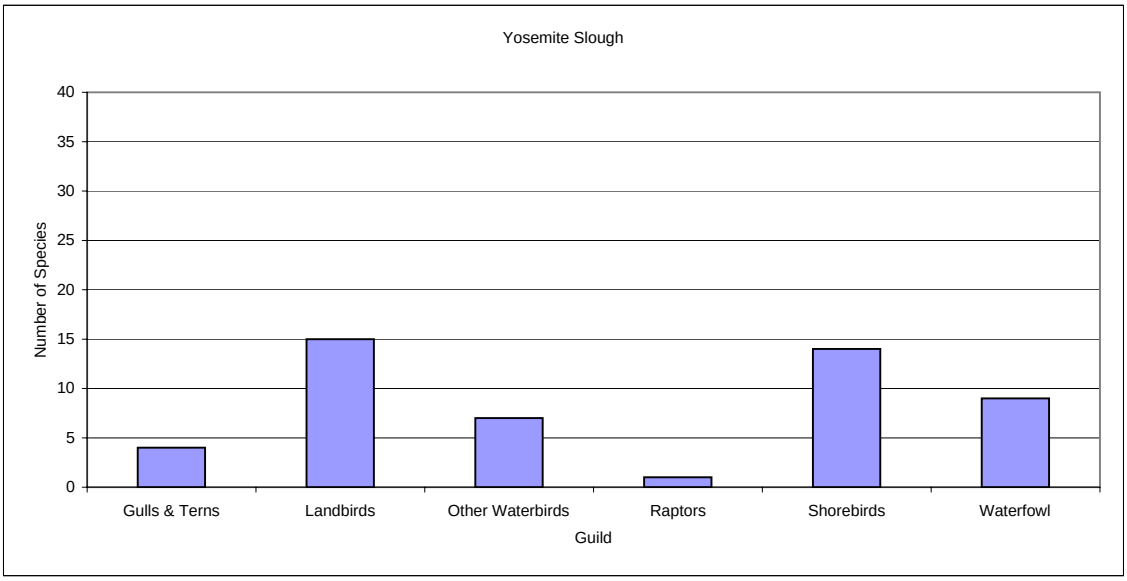


Figure 3. Species Diversity of Birds in the Yosemite Slough Sub-Area, (January 2003 - April 2004)

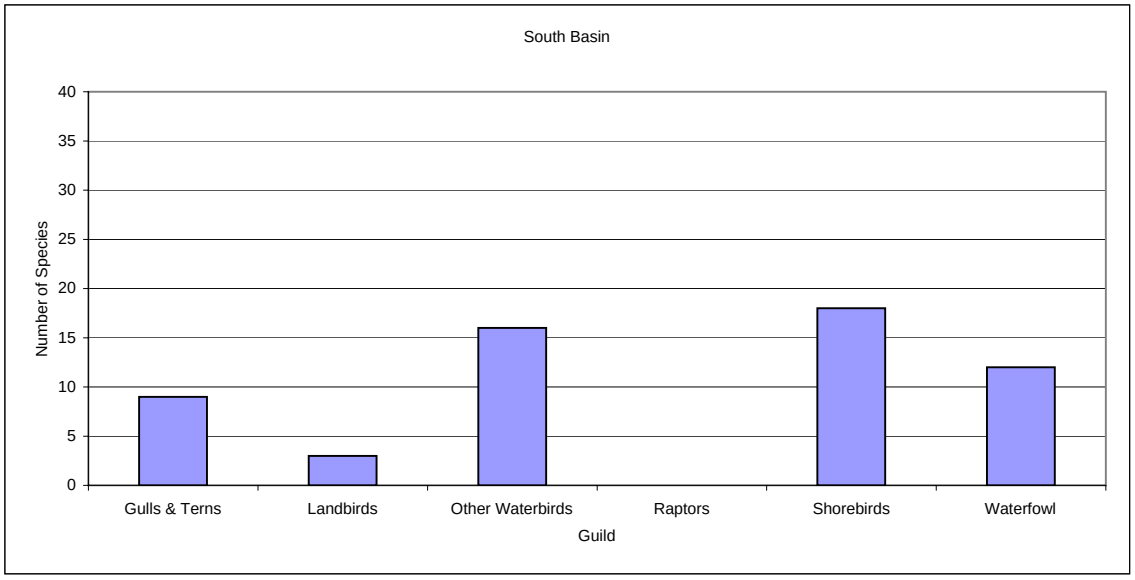


Figure 4. Species Diversity of Birds in the South Basin Sub-Area, (January 2003 - April 2004)

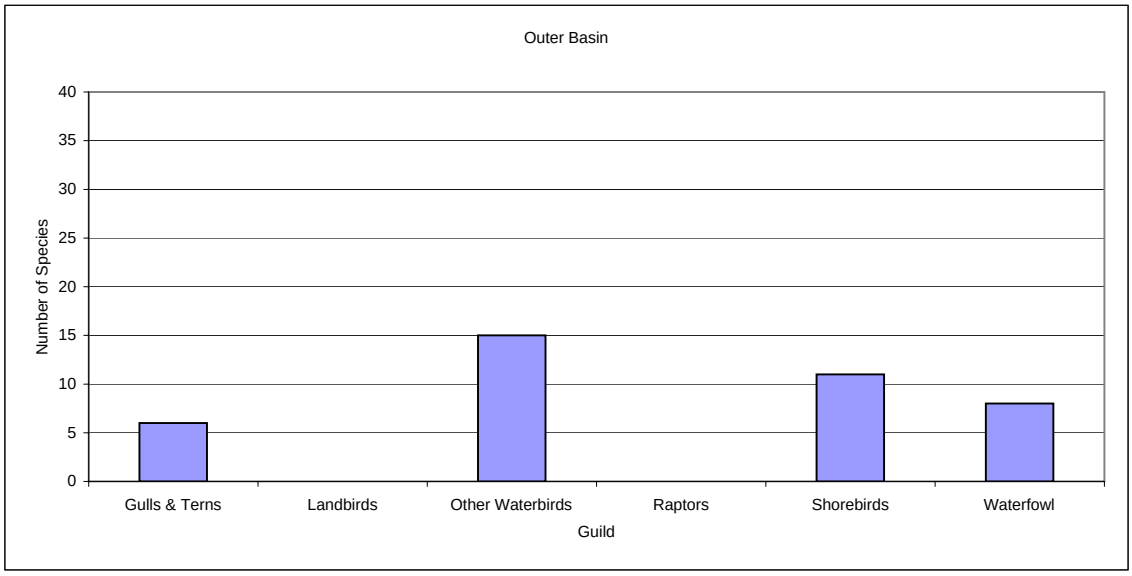


Figure 5. Species Diversity of Birds in the Outer Basin Sub-Area, (January 2003 - April 2004)

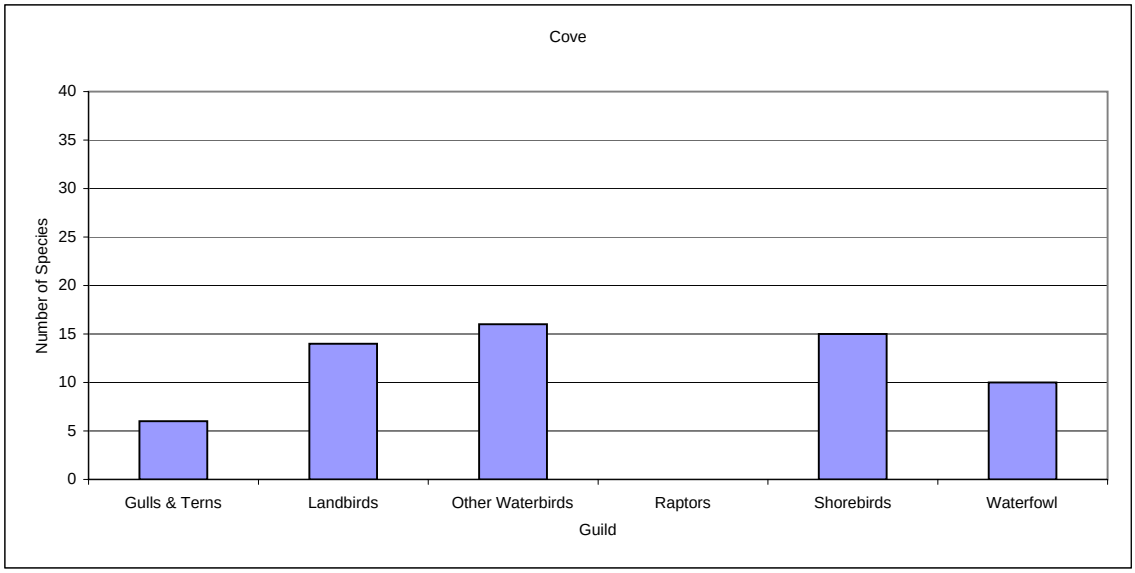


Figure 6. Species Diversity of Birds in the Cove Sub-Area, (January 2003 - April 2004)

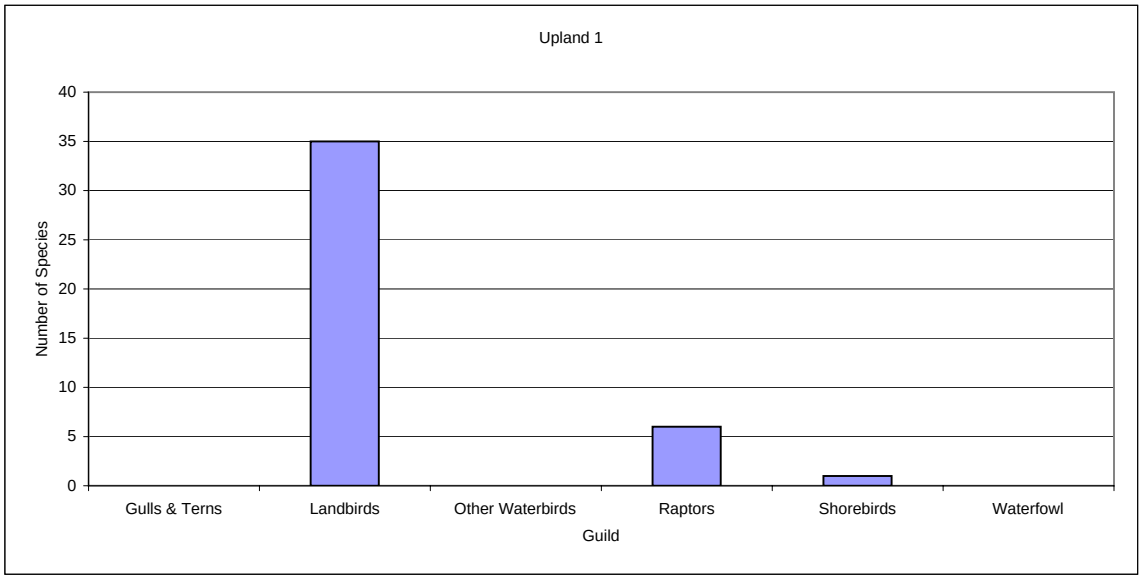


Figure 7. Species Diversity of Birds in the Upland 1 Sub-Area, (January 2003 - April 2004)

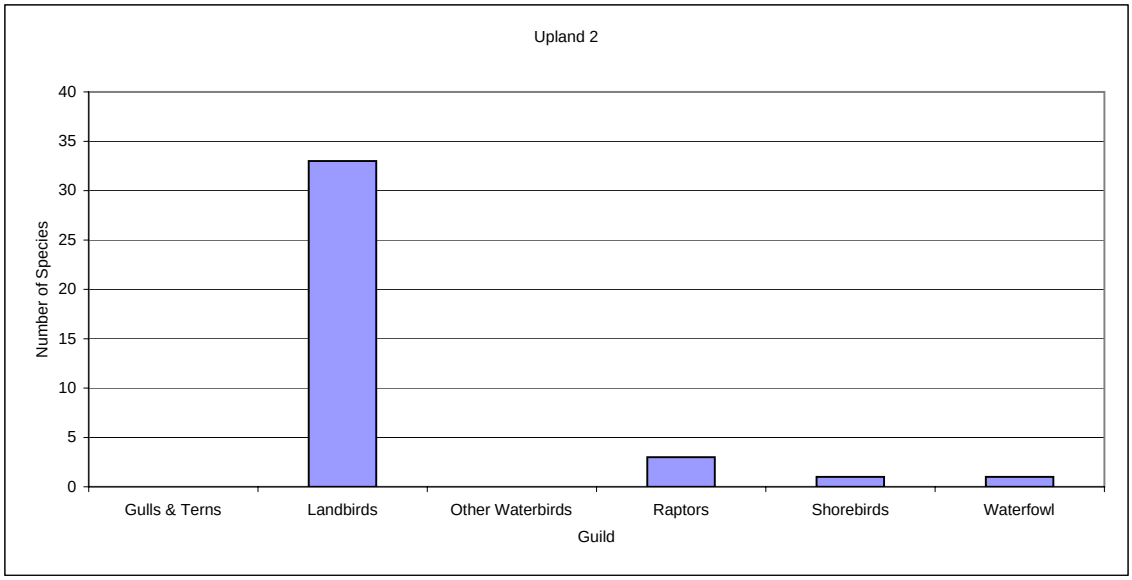


Figure 8. Species Diversity of Birds in the Upland 2 Sub-Area, (January 2003 - April 2004)

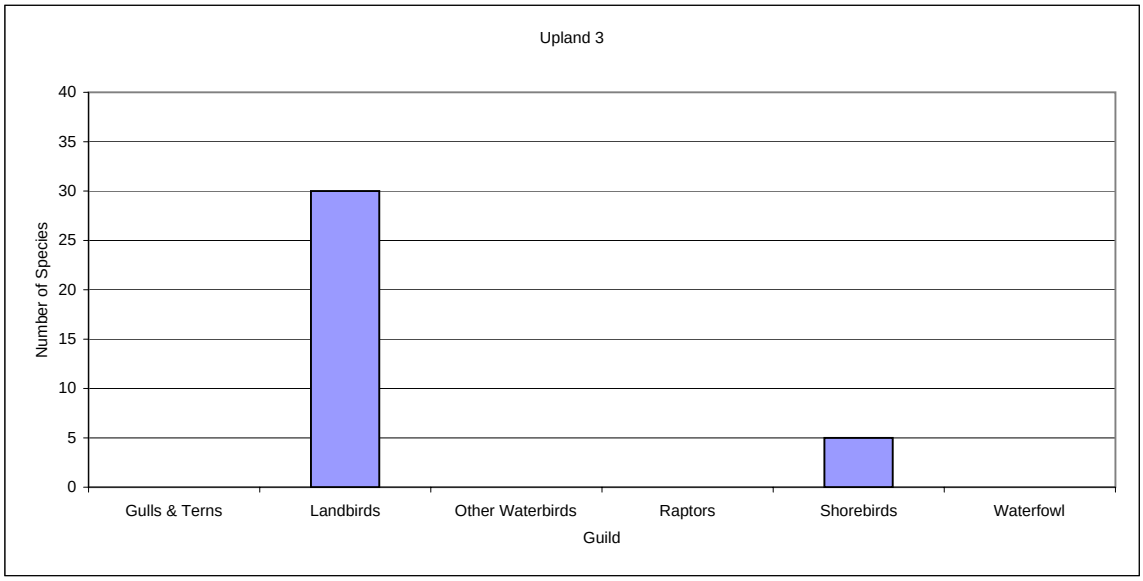


Figure 9. Species Diversity of Birds in the Upland 3 Sub-Area, (January 2003 - April 2004)

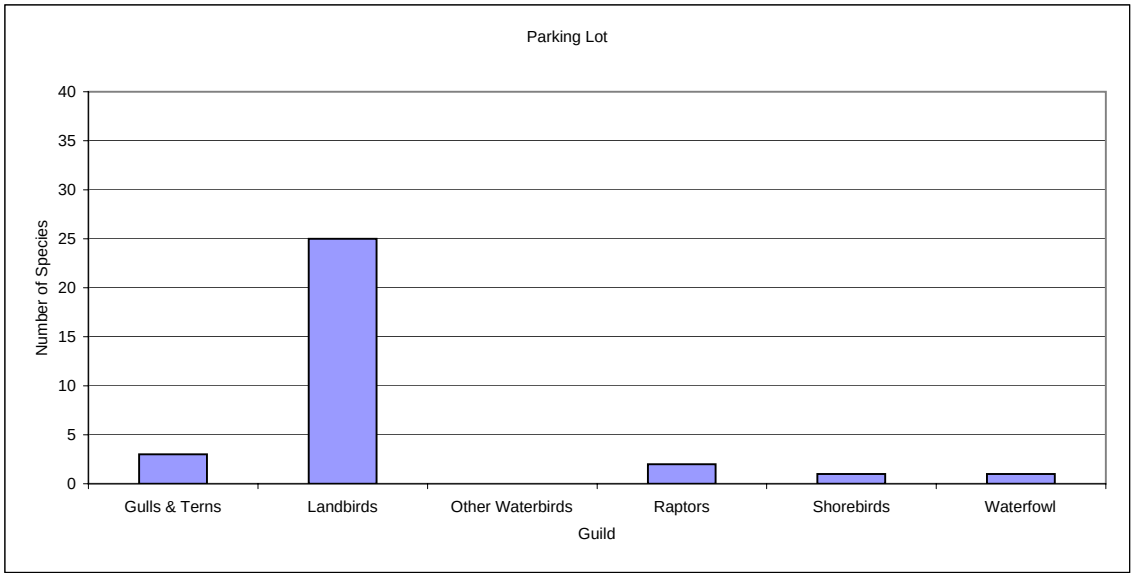


Figure 10. Species Diversity of Birds in the Parking Lot Sub-Area, (January 2003 - April 2004)

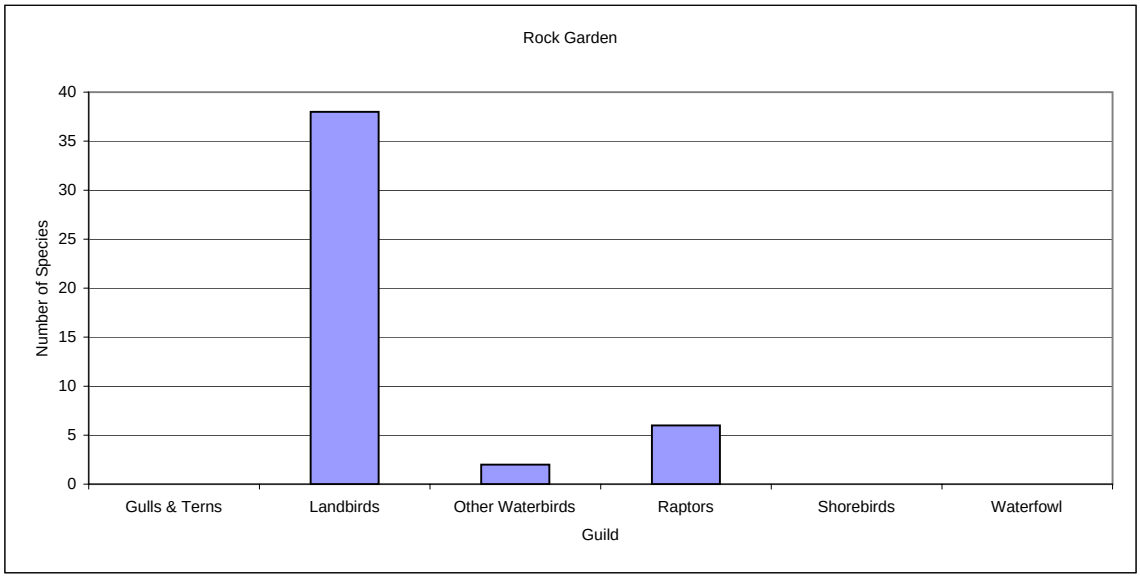


Figure 11. Species Diversity of Birds in the Rock Garden Sub-Area, (January 2003 - April 2004)

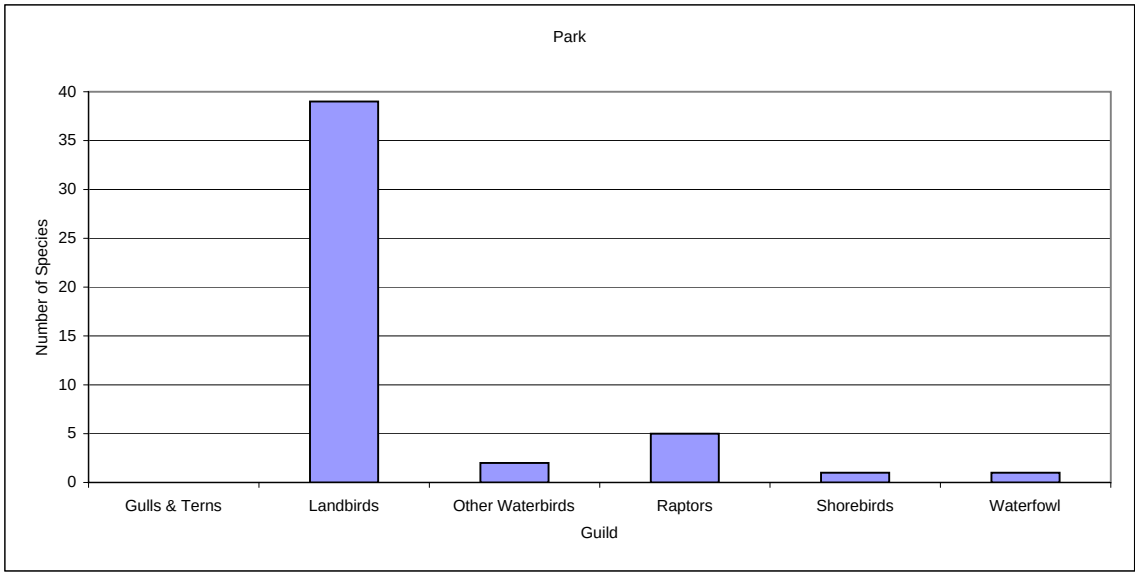


Figure 12. Species Diversity of Birds in the Park Sub-Area, (January 2003 - April 2004)

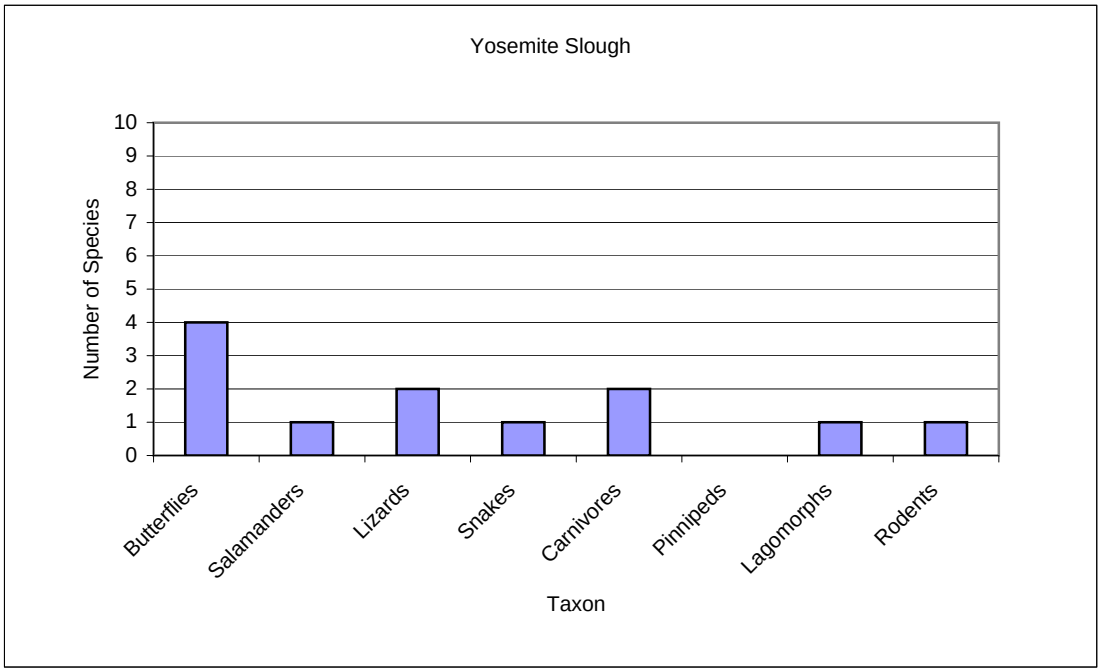


Figure 13. Species Diversity of Butterflies, Amphibians, Reptiles, and Mammals, January 2003 - April 2004

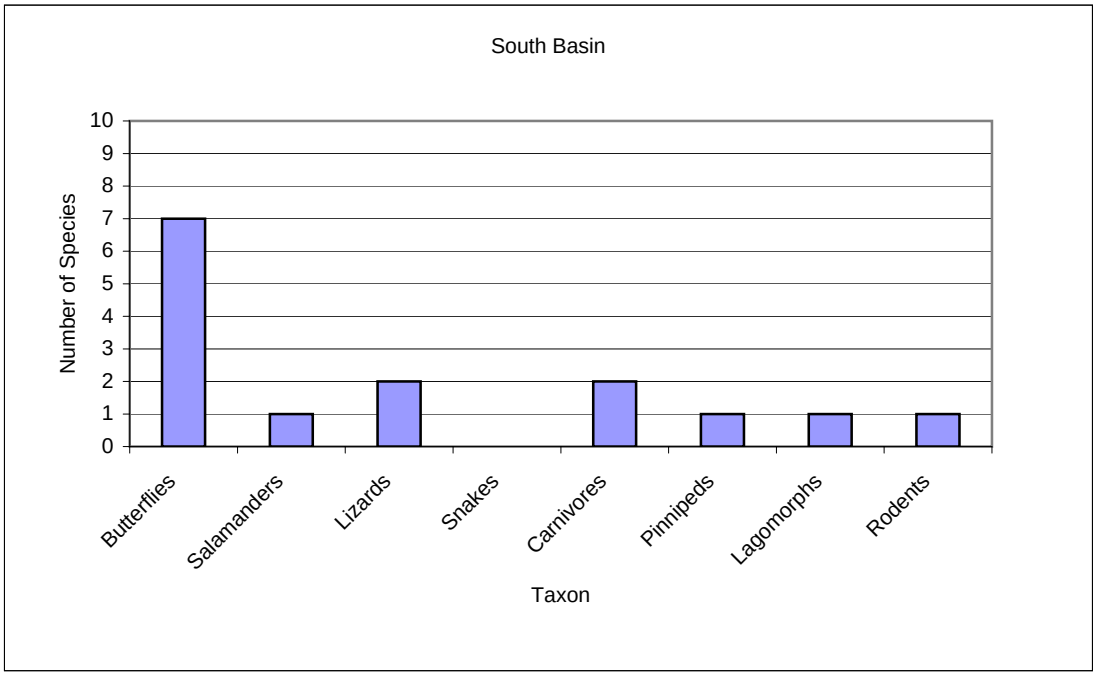


Figure 14. Species Diversity of Butterflies, Amphibians, Reptiles, and Mammals, January 2003 - April 2004

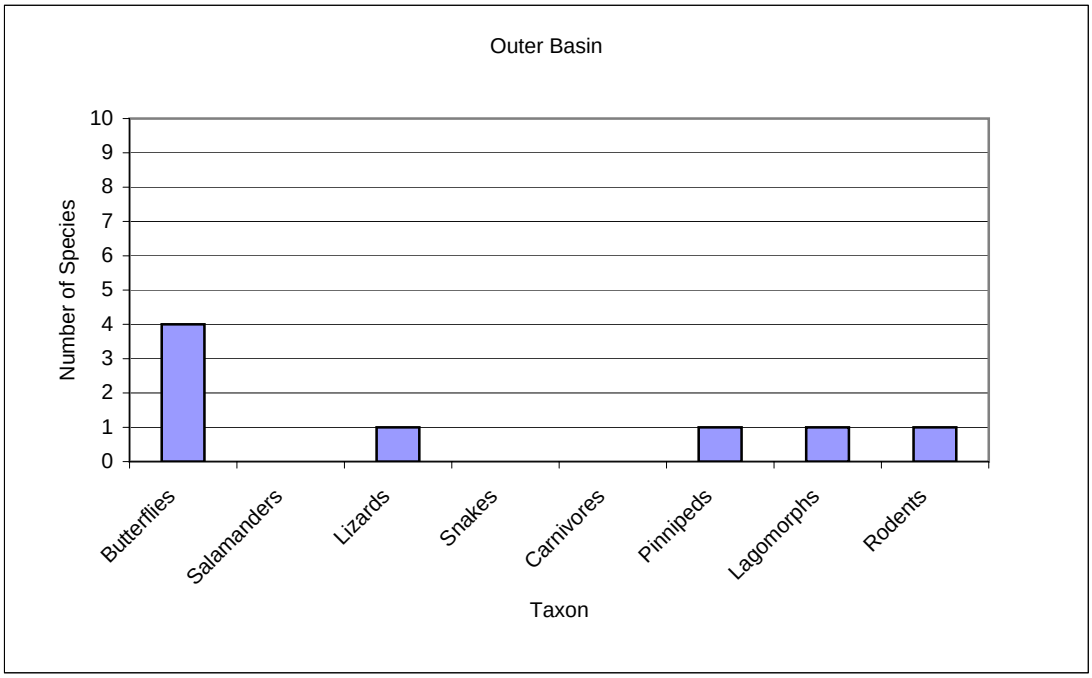


Figure 15. Species Diversity of Butterflies, Amphibians, Reptiles, and Mammals, January 2003 - April 2004

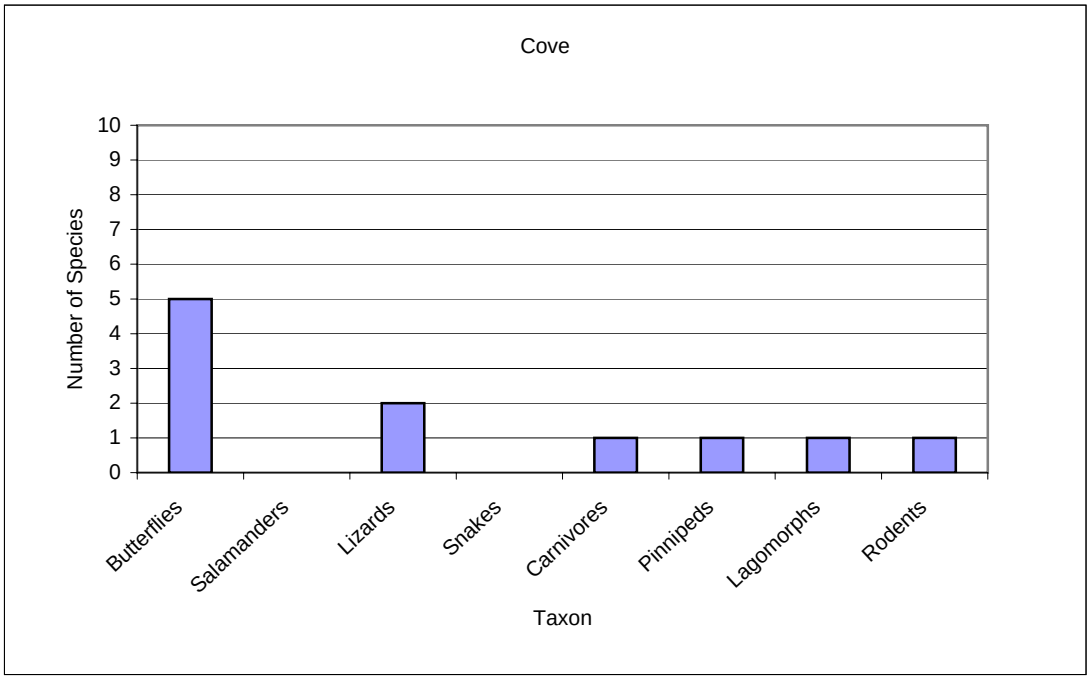


Figure 16. Species Diversity of Butterflies, Amphibians, Reptiles, and Mammals, January 2003 - April 2004

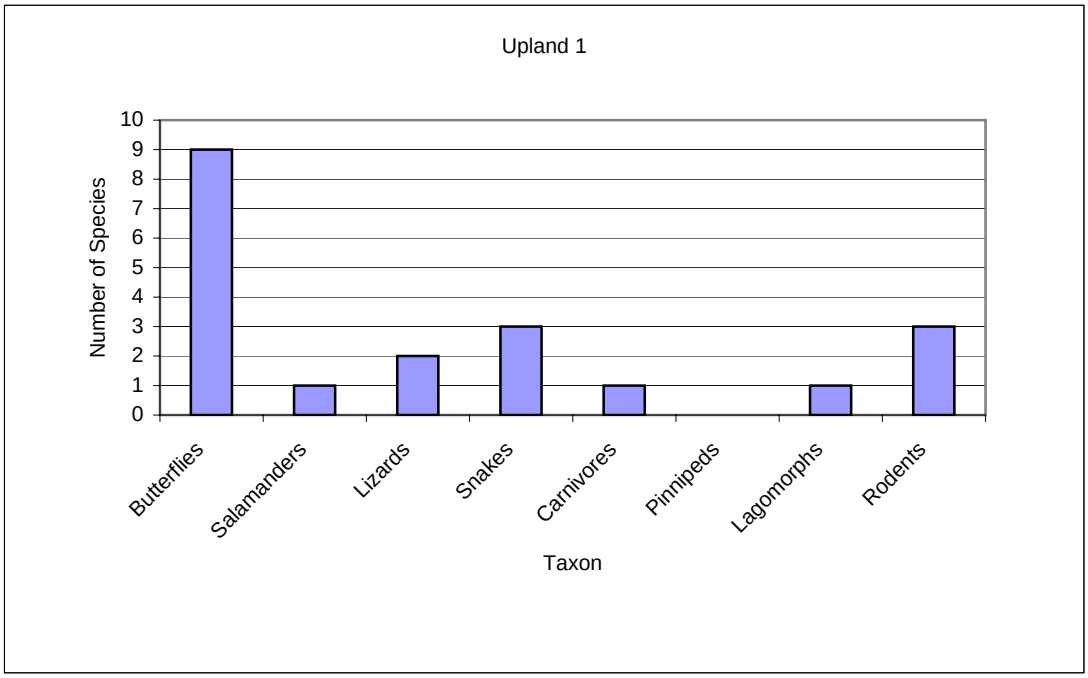


Figure 17. Species Diversity of Butterflies, Amphibians, Reptiles, and Mammals, January 2003 - April 2004

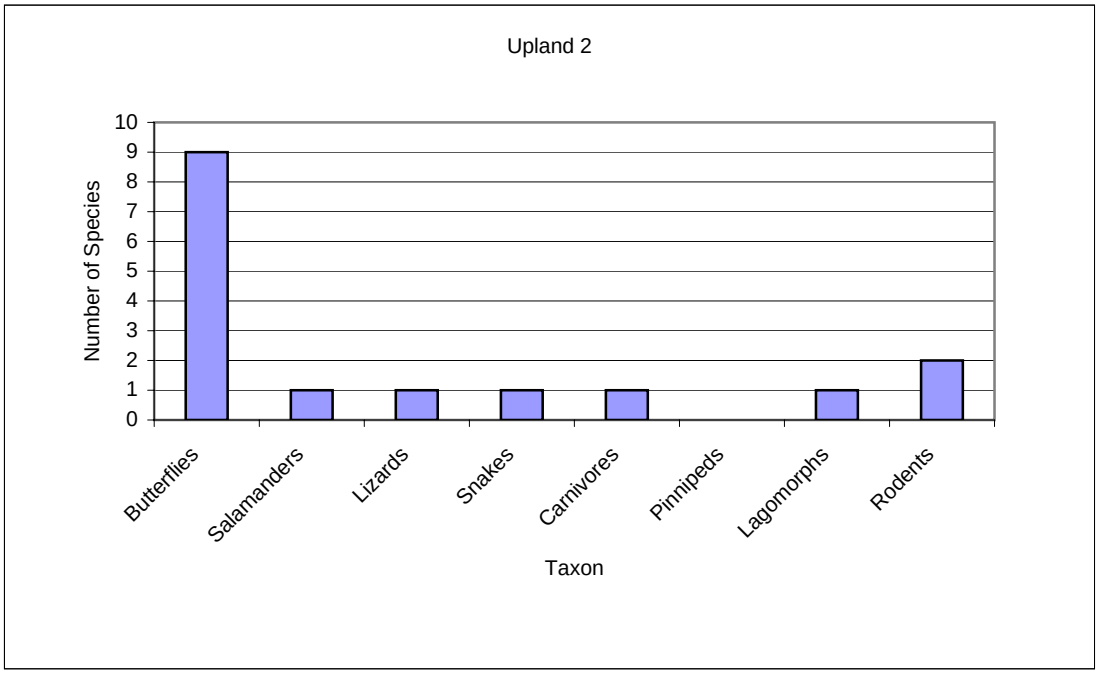


Figure 18. Species Diversity of Butterflies, Amphibians, Reptiles, and Mammals, January 2003 - April 2004

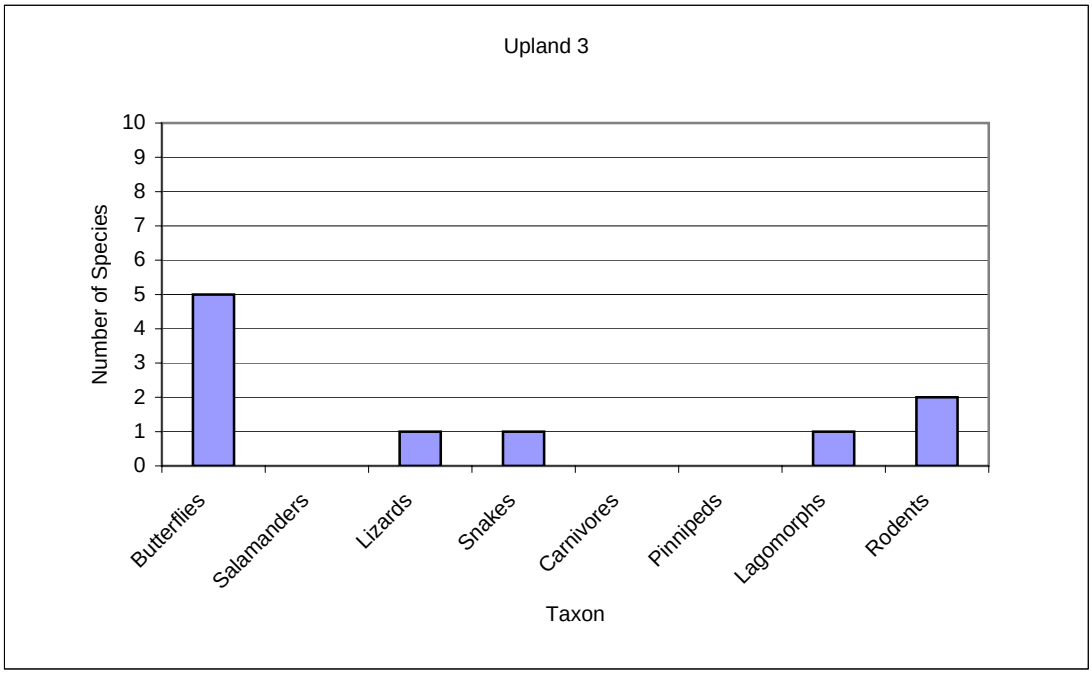


Figure 19. Species Diversity of Butterflies, Amphibians, Reptiles, and Mammals, January 2003 - April 2004

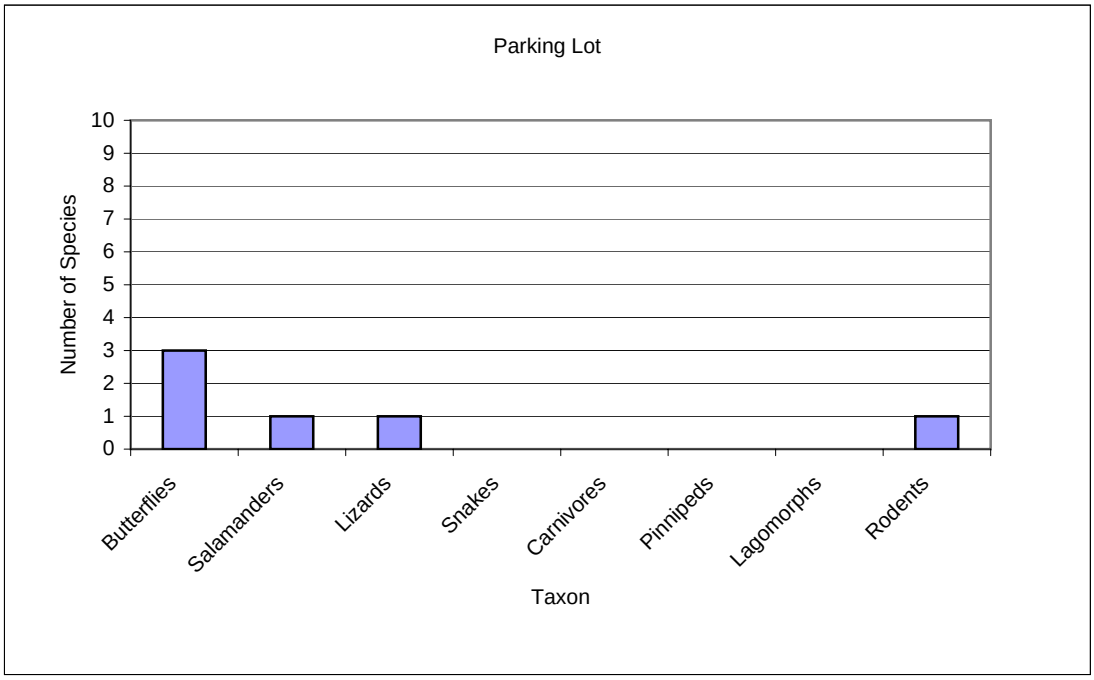


Figure 20. Species Diversity of Butterflies, Amphibians, Reptiles, and Mammals, January 2003 - April 2004

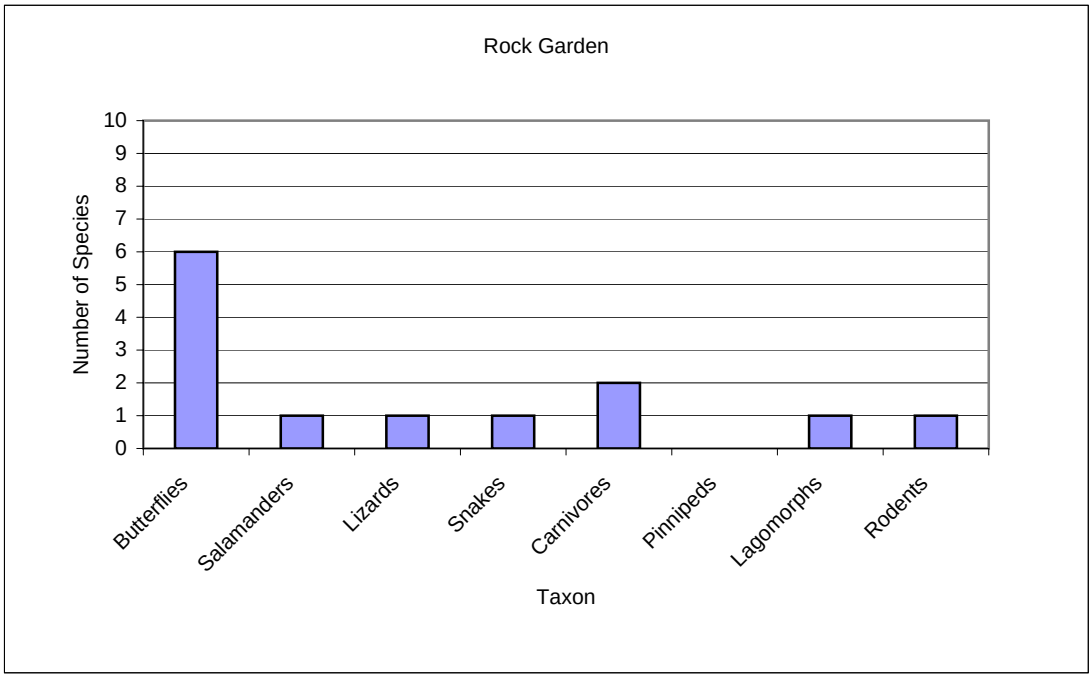


Figure 21. Species Diversity of Butterflies, Amphibians, Reptiles, and Mammals, January 2003 - April 2004

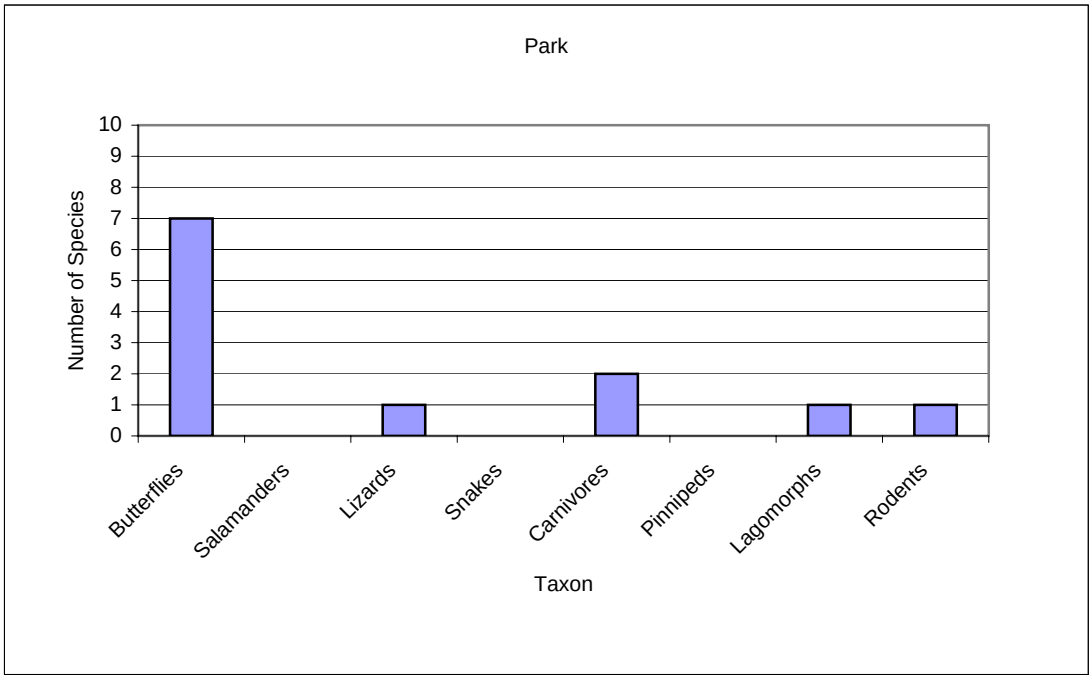
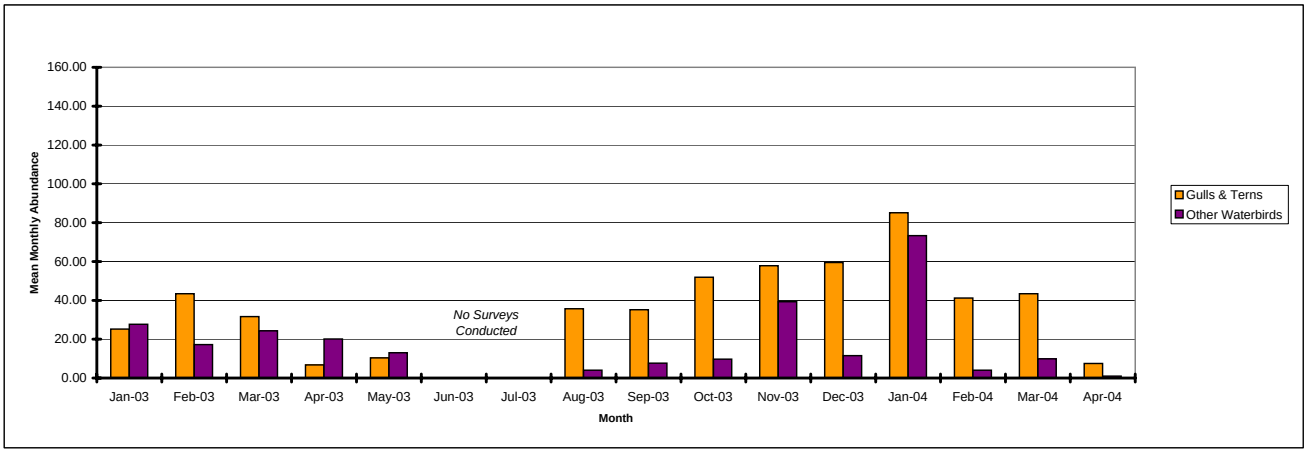
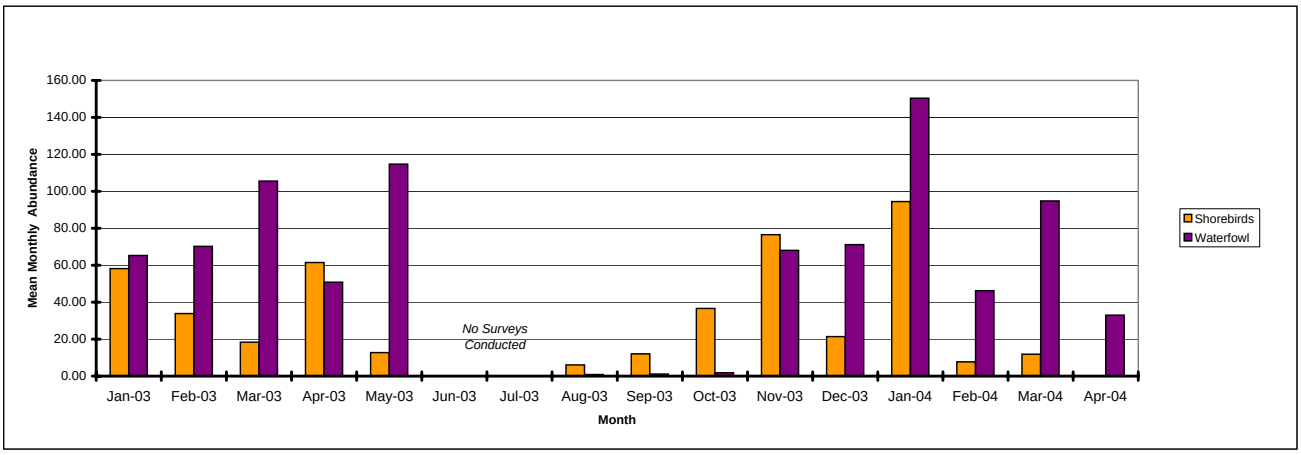


Figure 22. Species Diversity of Butterflies, Amphibians, Reptiles, and Mammals, January 2003 - April 2004





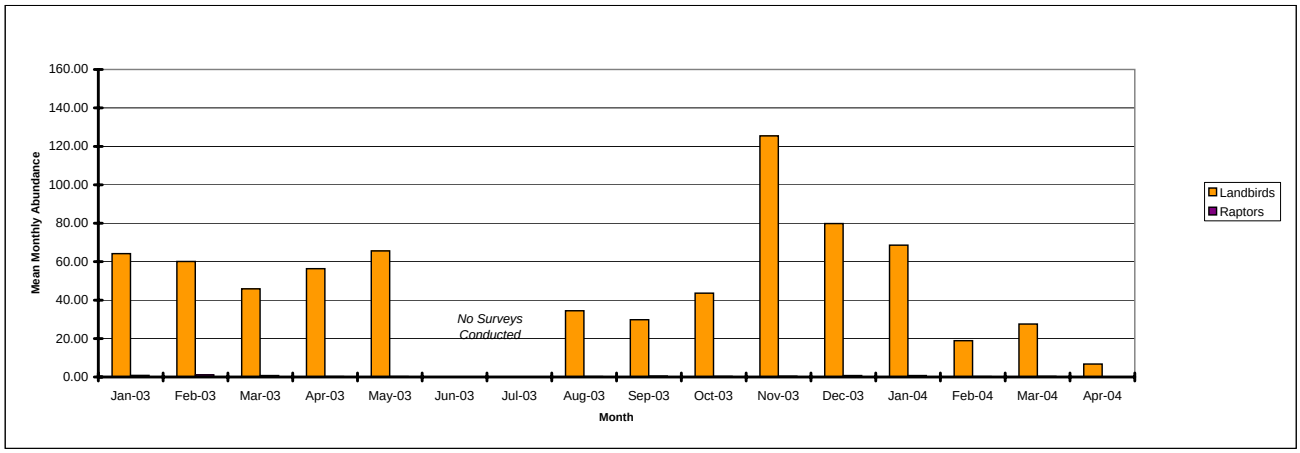


Figure 23. Mean Abundance of Birds By Guild and Month. Yosemite Slough Study Area, San Francisco, CA

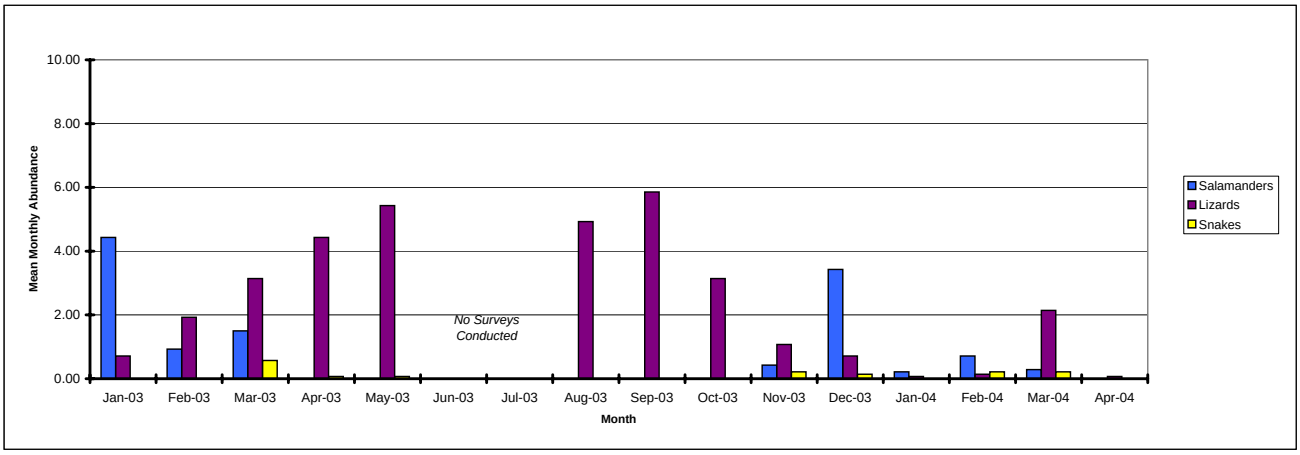


Figure 24. Mean Abundance of Amphibians and Reptiles By Month. Yosemite Slough Study Area, San Francisco, CA

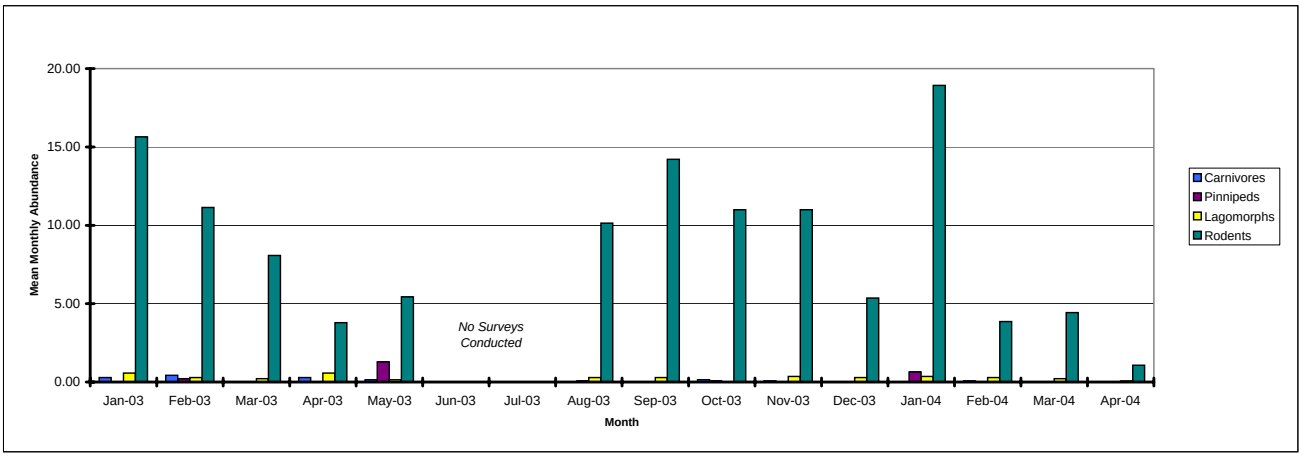


Figure 25. Mean Abundance of Mammals By Month. Yosemite Slough Study Area, San Francisco, CA

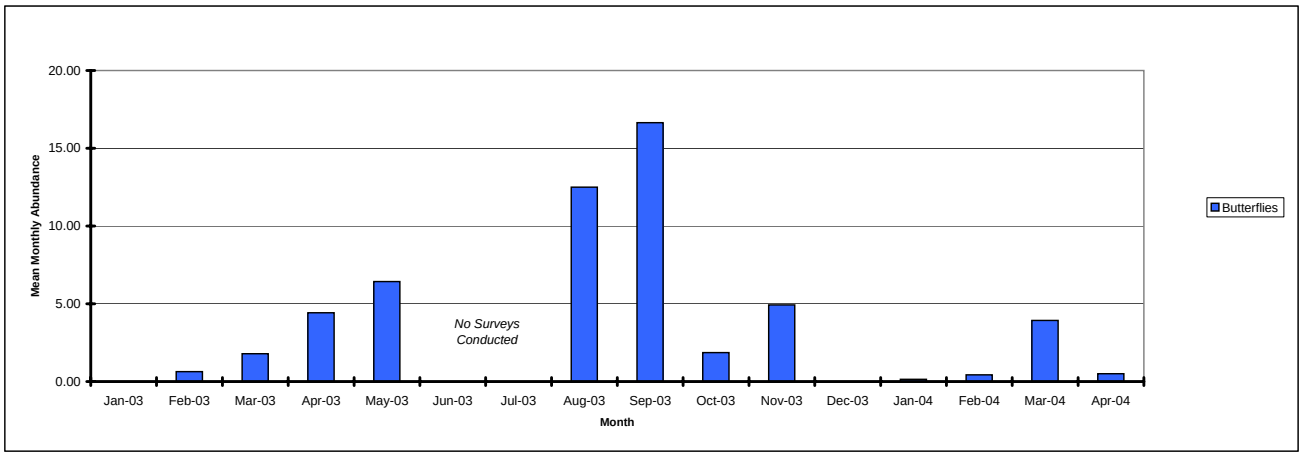
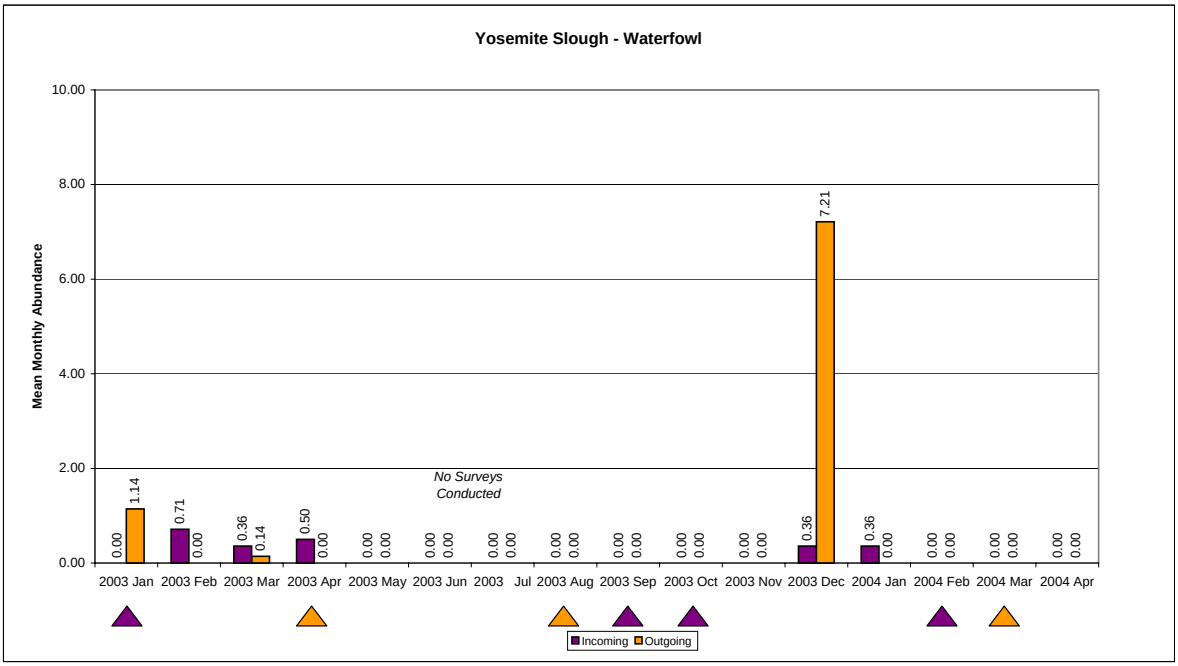


Figure 26. Mean Abundance of Butterflies By Month. Yosemite Slough Study Area, San Francisco, CA



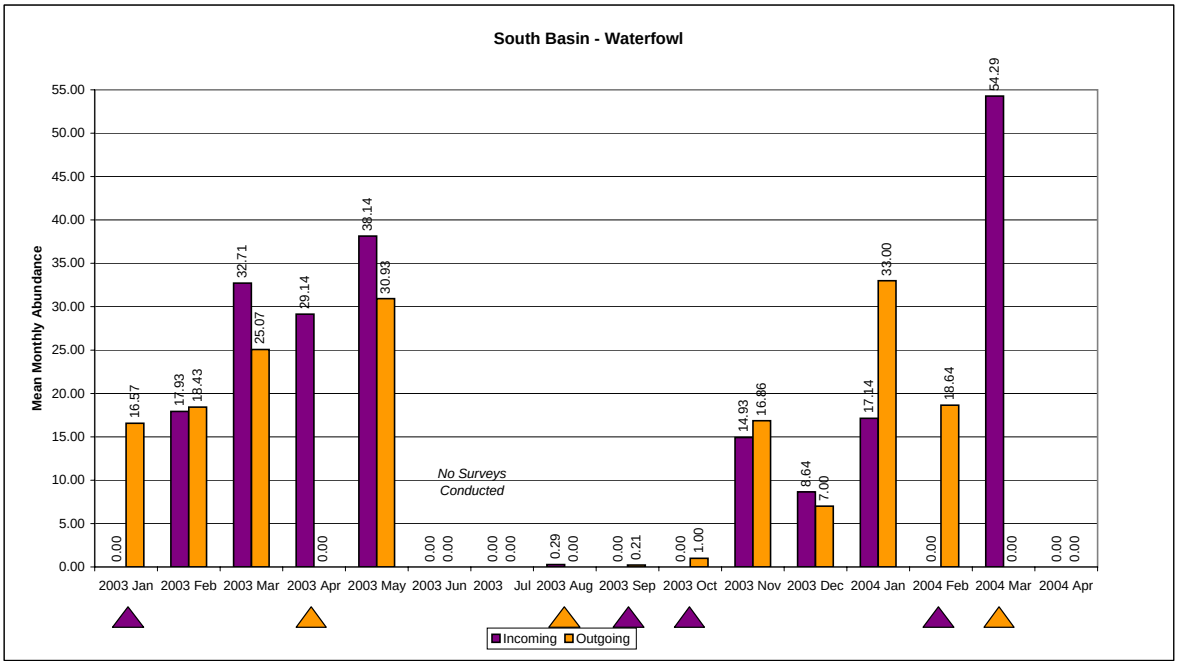
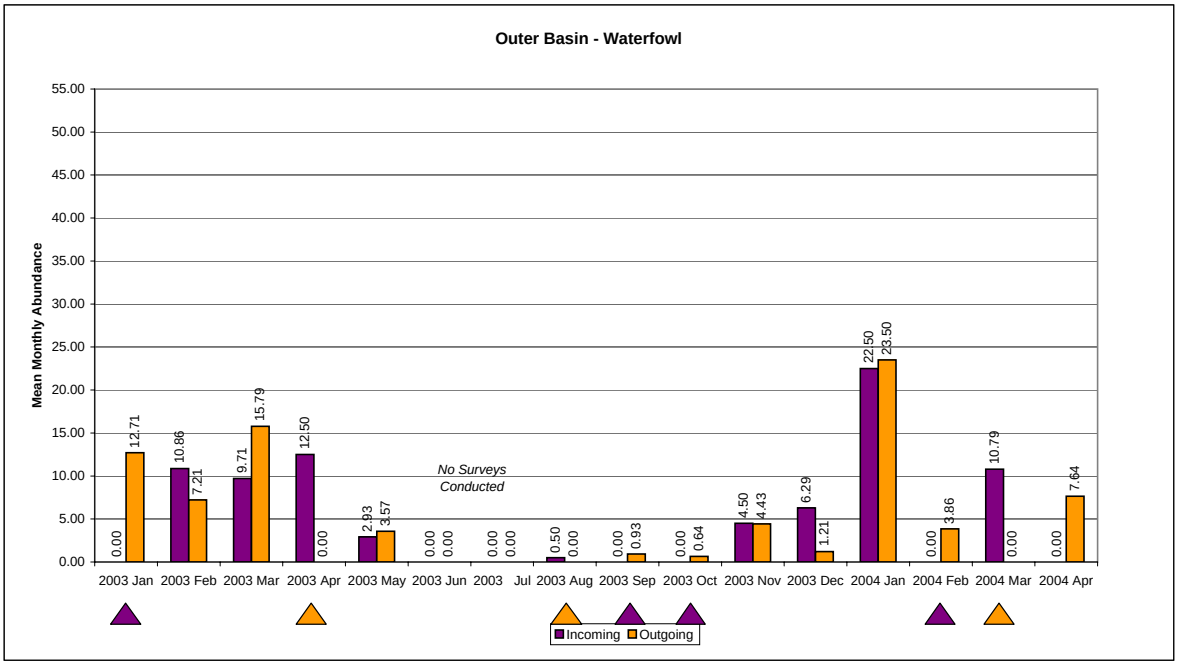


Figure 27A. Mean Abundance of Waterfowl by Tidal Stage and Sub-Area, Yosemite Slough Study Area, San Francisco, CA. Triangles below the month indicates that no incoming (purple) or outgoing (orange) survey was conducted.



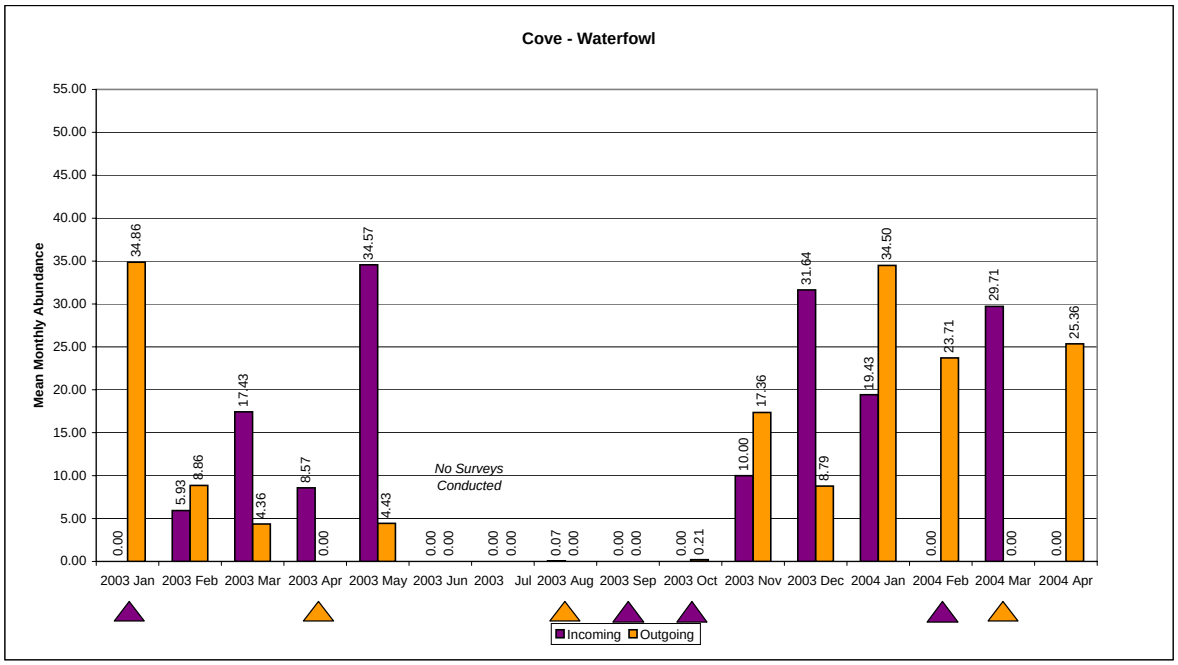
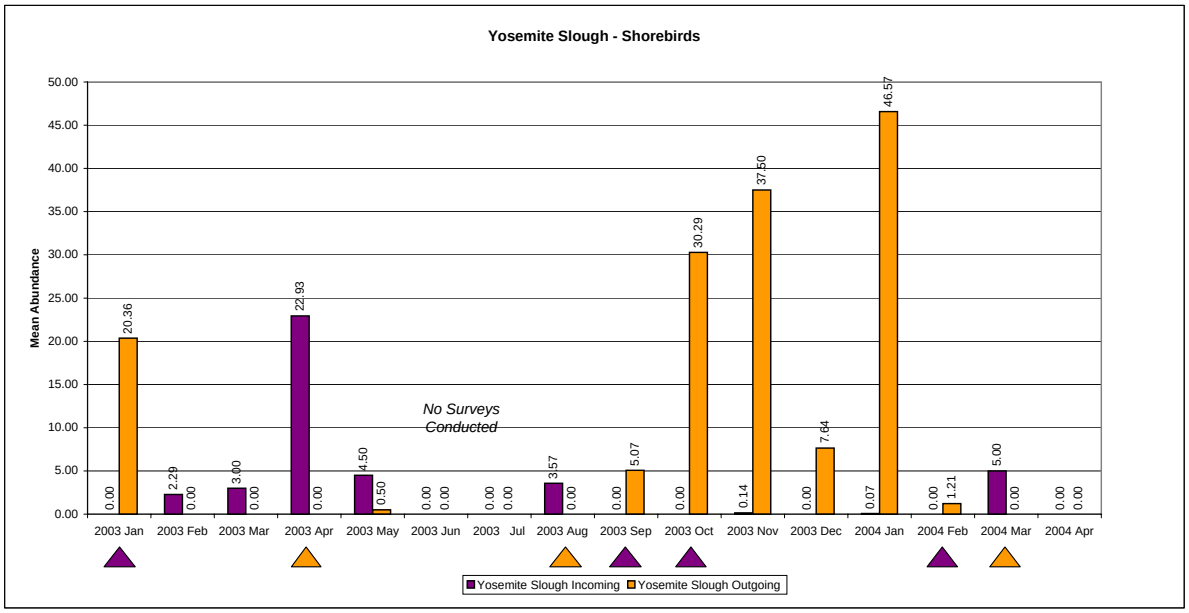


Figure 27B. Mean Abundance of Waterfowl by Tidal Stage and Sub-Area, Yosemite Slough Study Area, San Francisco, CA. Triangles below the month indicates that no incoming (purple) or outgoing (orange) survey was conducted.



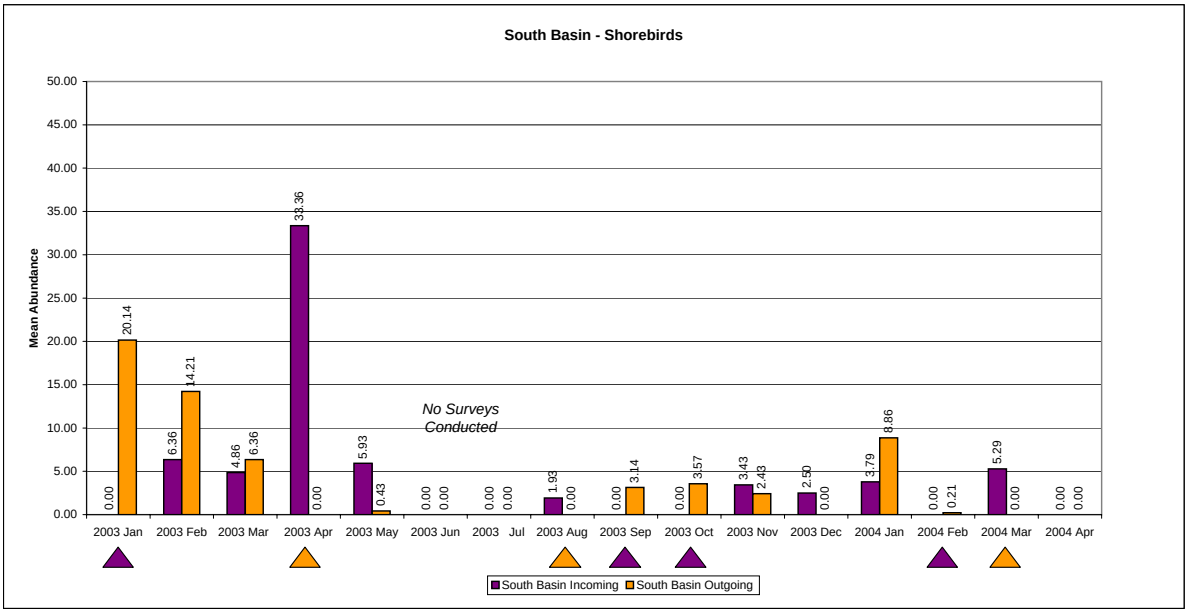
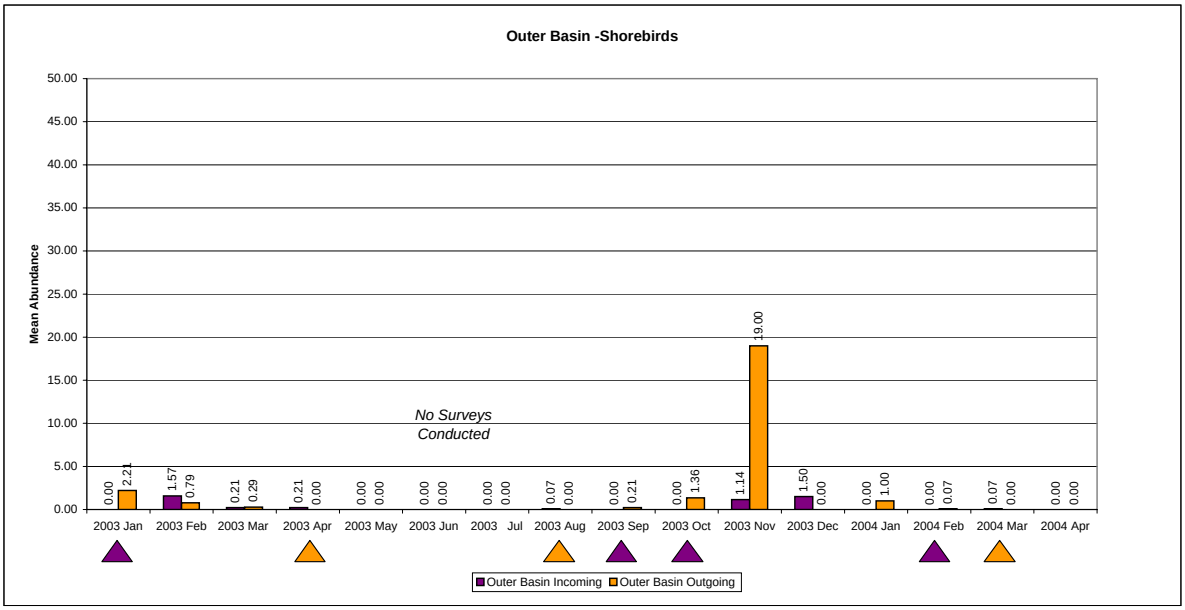


Figure 28A. Mean Abundance of Shorebirds by Tidal Stage and Sub-Area, Yosemite Slough Study Area, San Francisco, CA. Triangles below the month indicates that no incoming (purple) or outgoing (orange) survey was conducted.



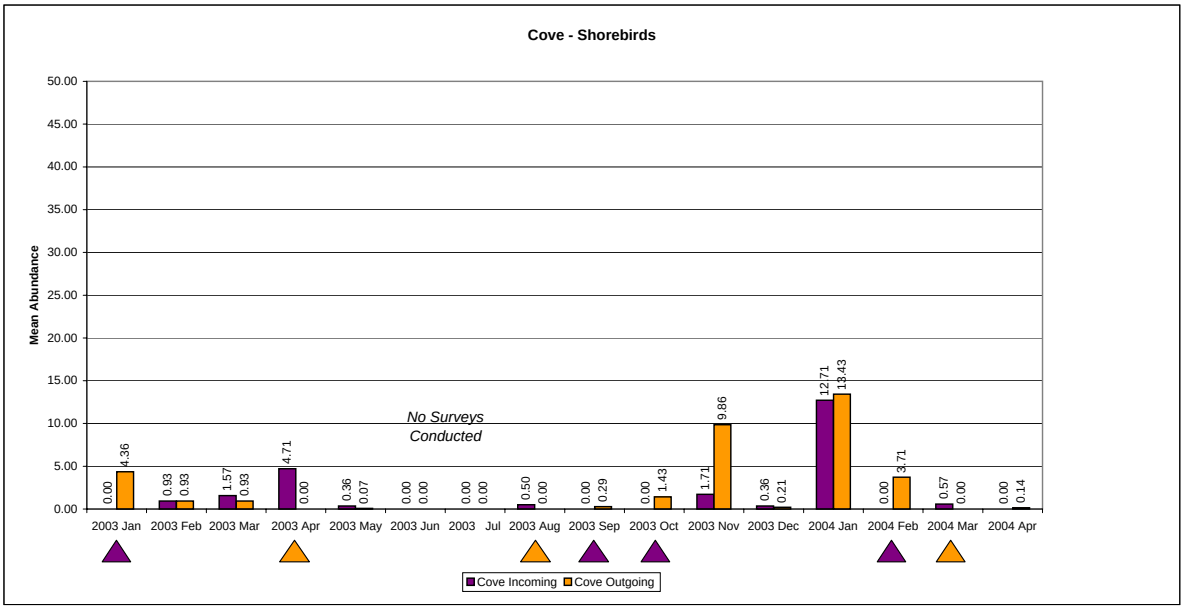


Figure 28B. Mean Abundance of Shorebirds by Tidal Stage and Sub-Area, Yosemite Slough Study Area, San Francisco, CA. Triangles below the month indicates that no incoming (purple) or outgoing (orange) survey was conducted.

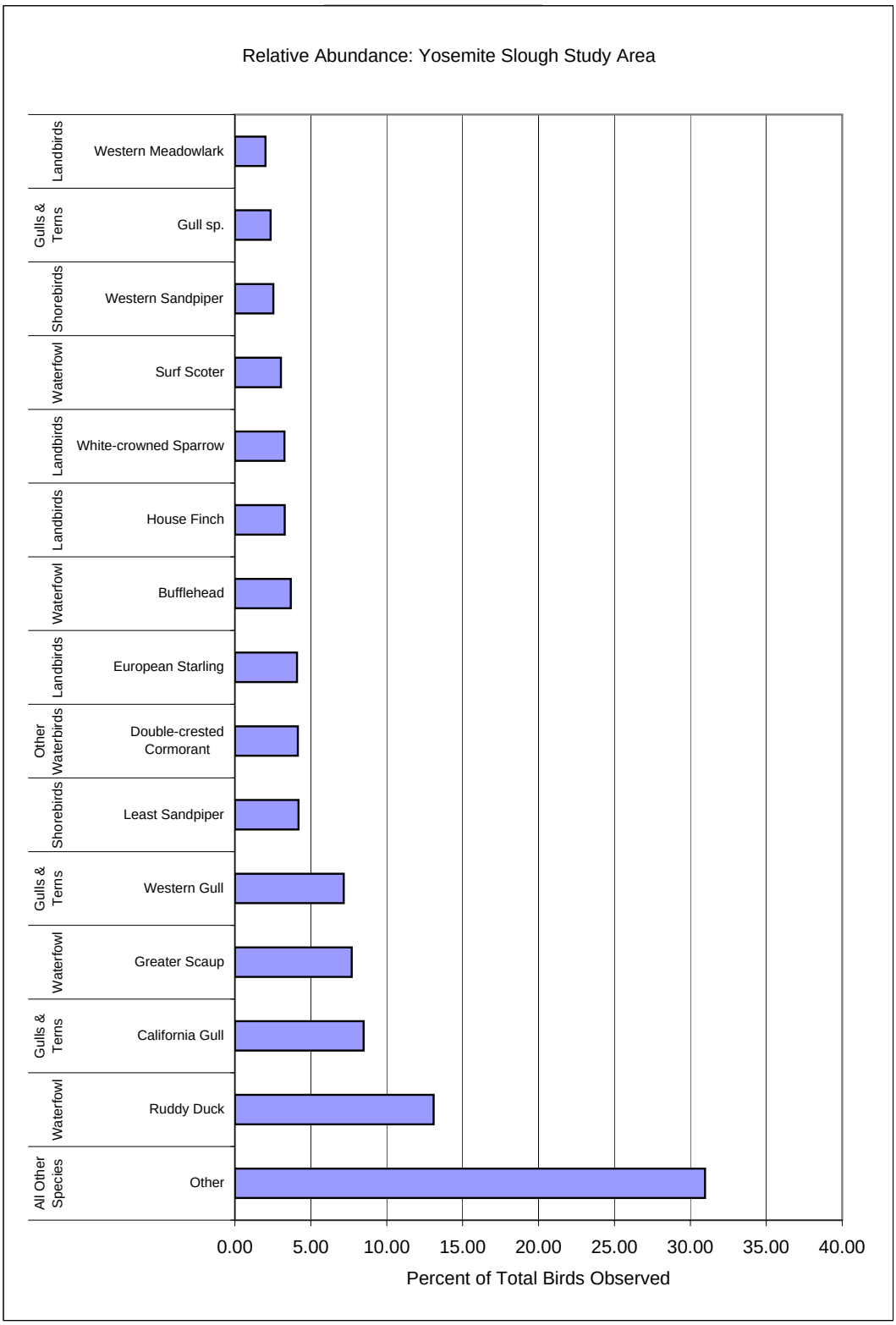
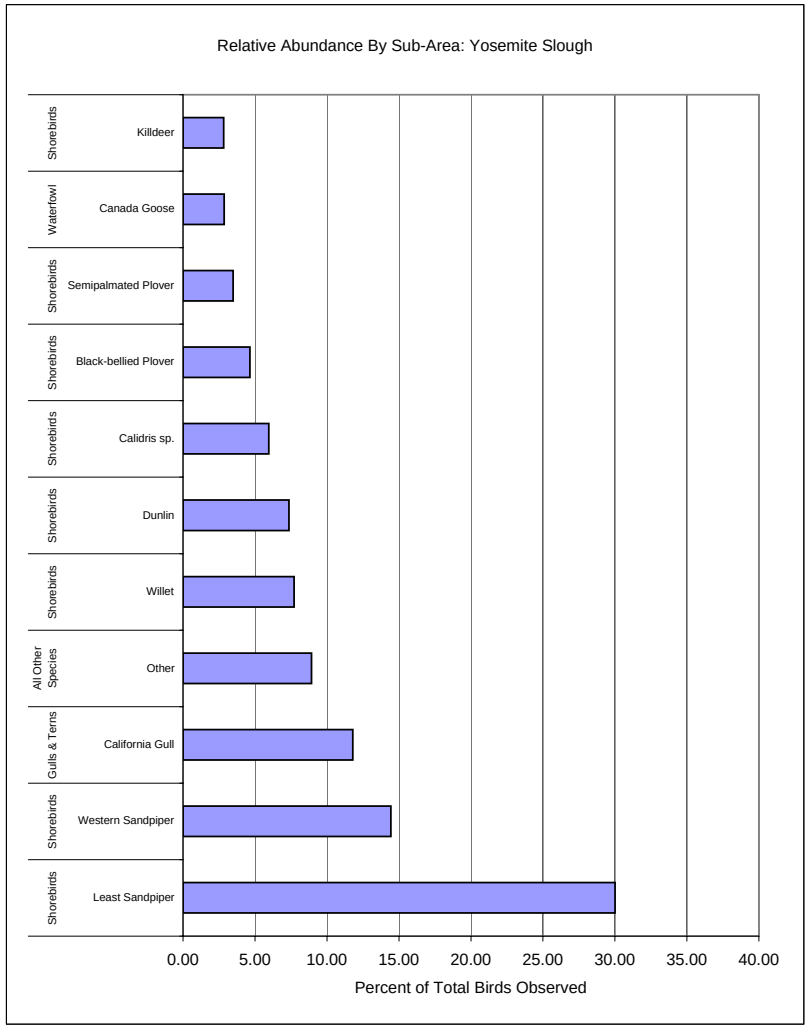


Figure 29-A. Relative Abundance of Birds for the Yosemite Slough Study Area (all sub-areas combined) (January 2003 through April 2004). Species comprising 2 percent or greater of the total number of birds observed in all sub-area are shown. Species comprising less than 2 percent of the total birds observed are combined and shown as "Other."



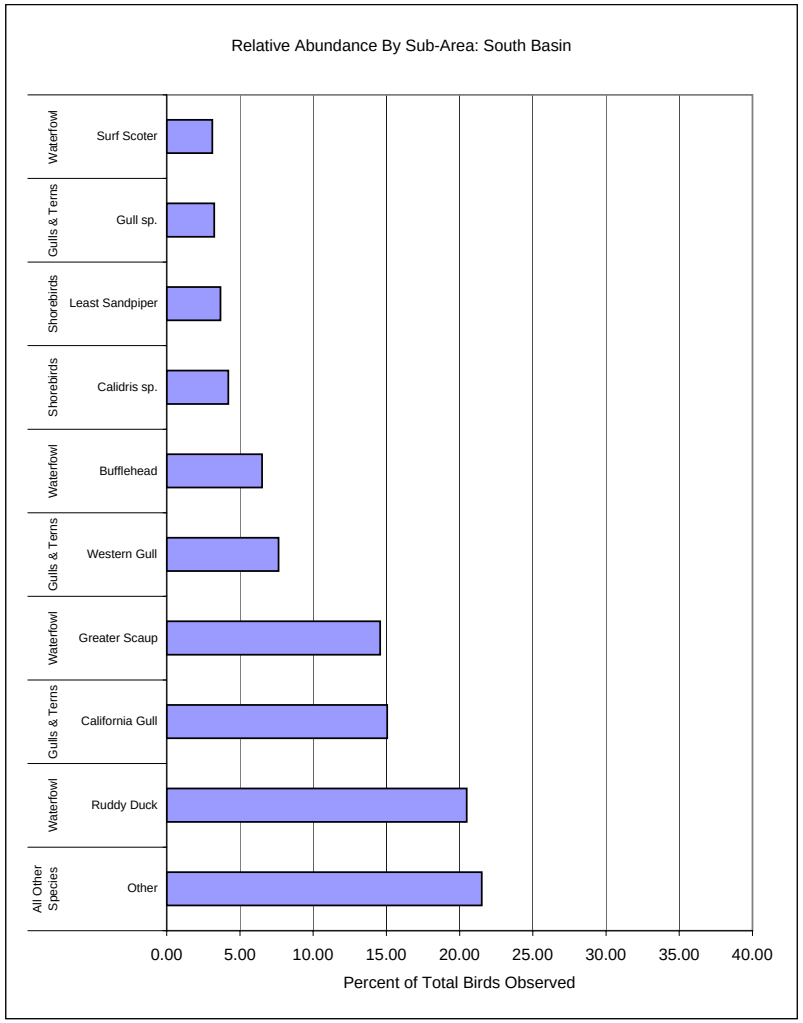
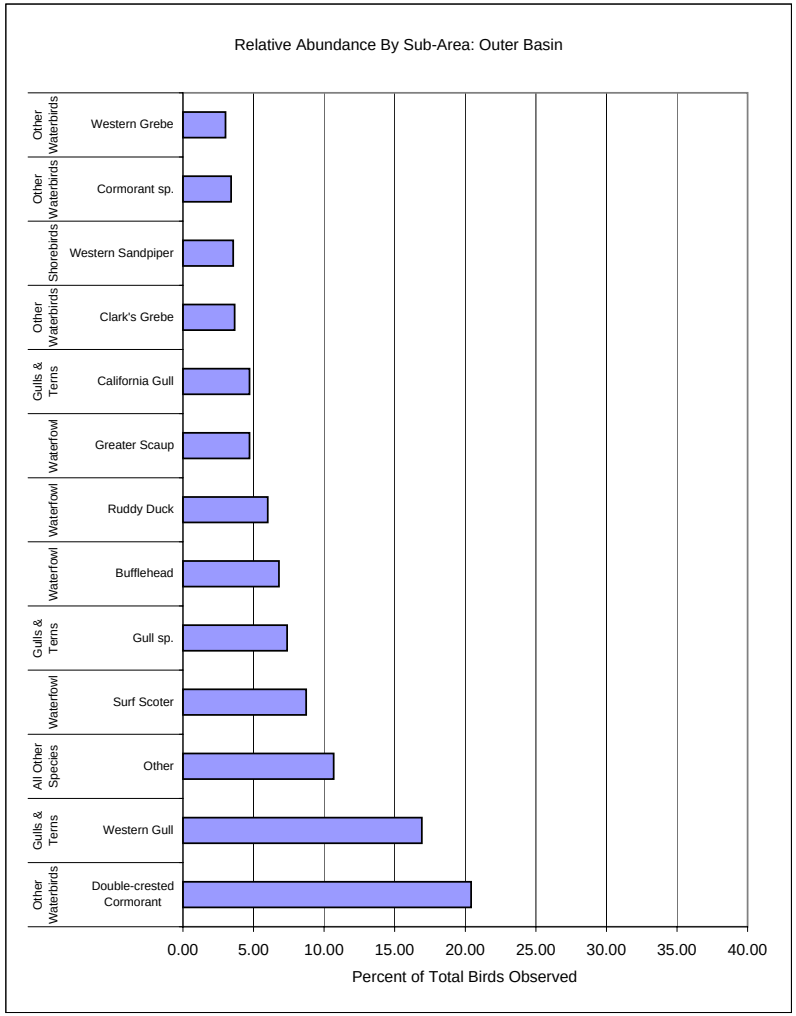


Figure 29-B1. Relative Abundance of Birds by Sub-Area (January 2003 through April 2004). Species comprising 2 percent or greater of the total number of birds observed in each sub-area are shown. Species comprising less than 2 percent of the total birds observed are combined and shown as "Other."



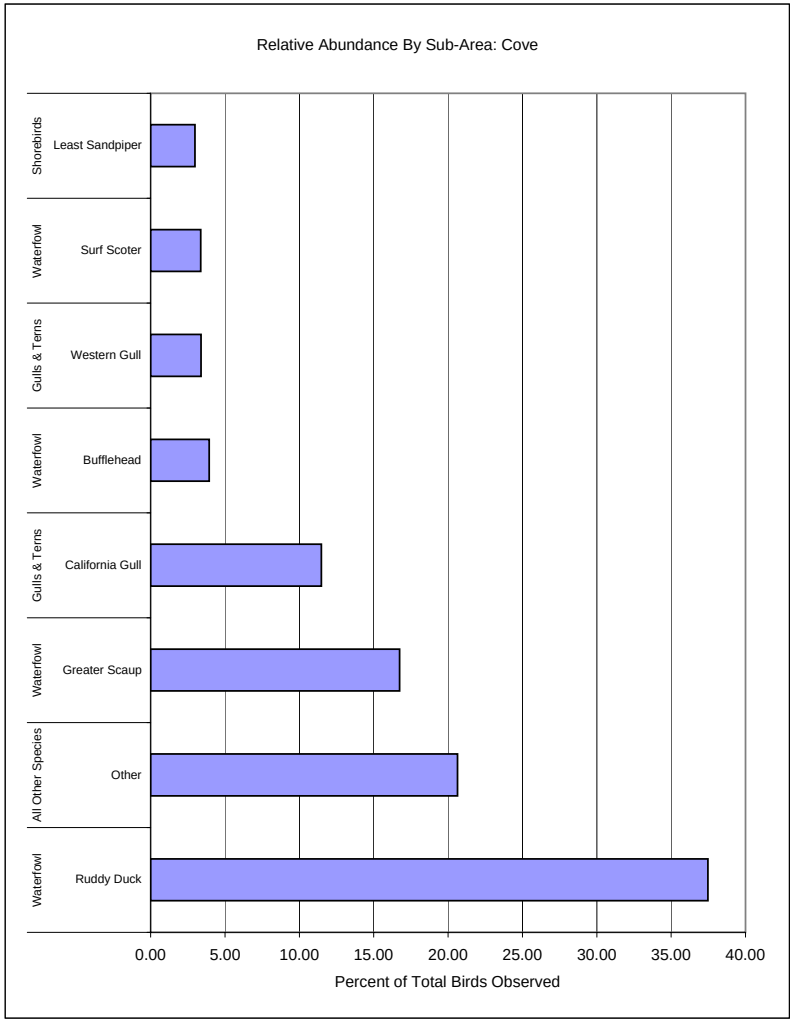
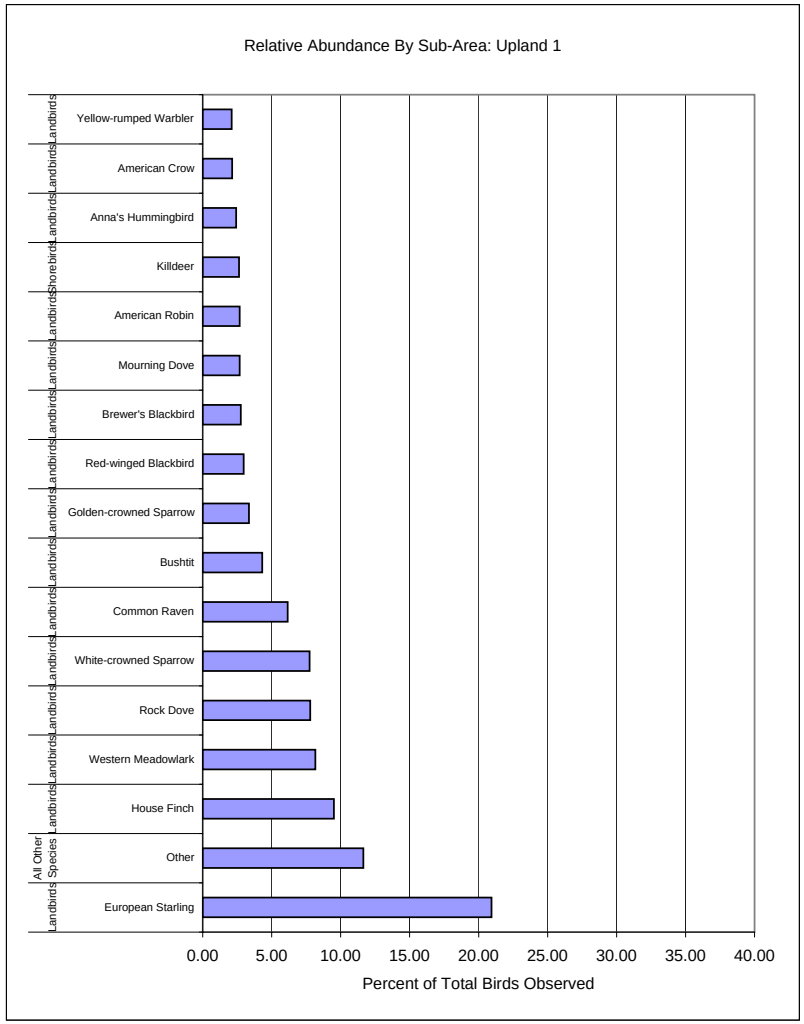


Figure 29-B2. Relative Abundance of Birds by Sub-Area (January 2003 through April 2004). Species comprising 2 percent or greater of the total number of birds observed in each sub-area are shown. Species comprising less than 2 percent of the total birds observed are combined and shown as "Other."



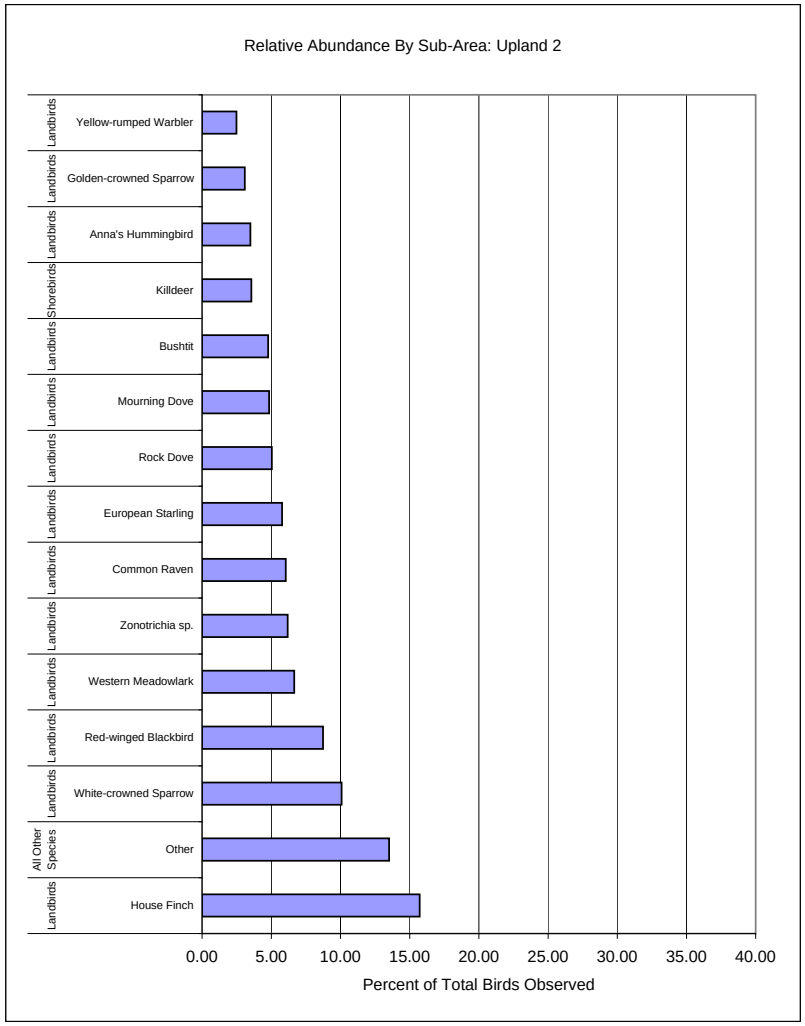
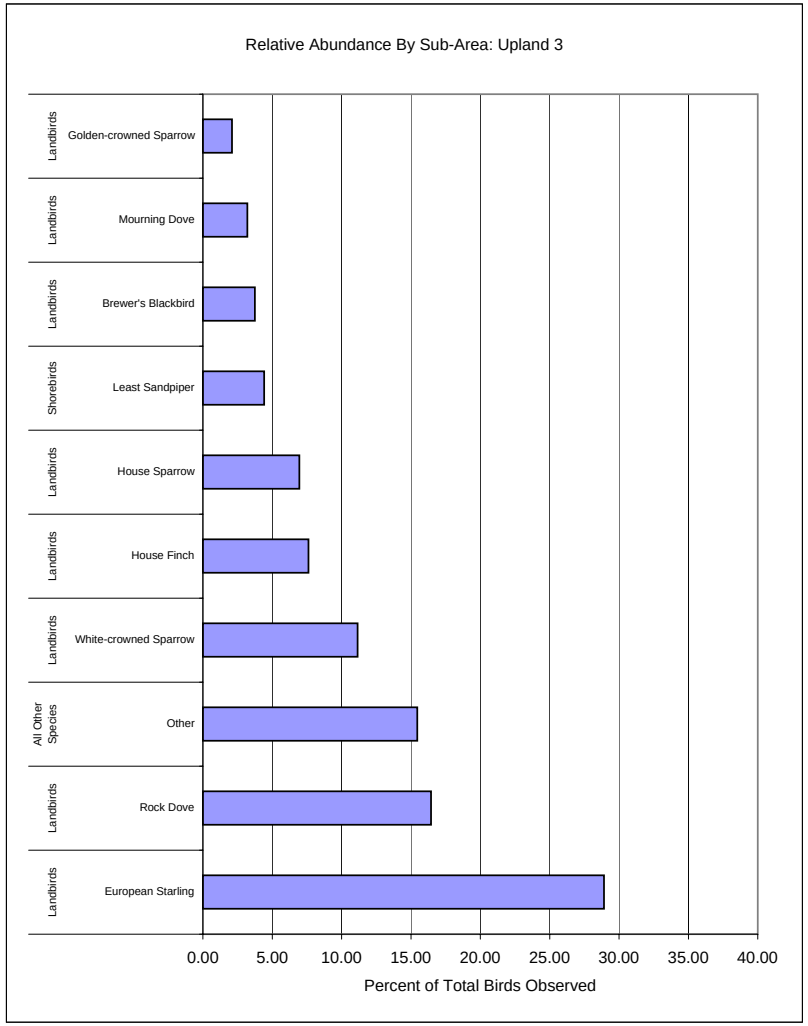


Figure 29-B3. Relative Abundance of Birds by Sub-Area (January 2003 through April 2004). Species comprising 2 percent or greater of the total number of birds observed in each sub-area are shown. Species comprising less than 2 percent of the total birds observed are combined and shown as "Other."



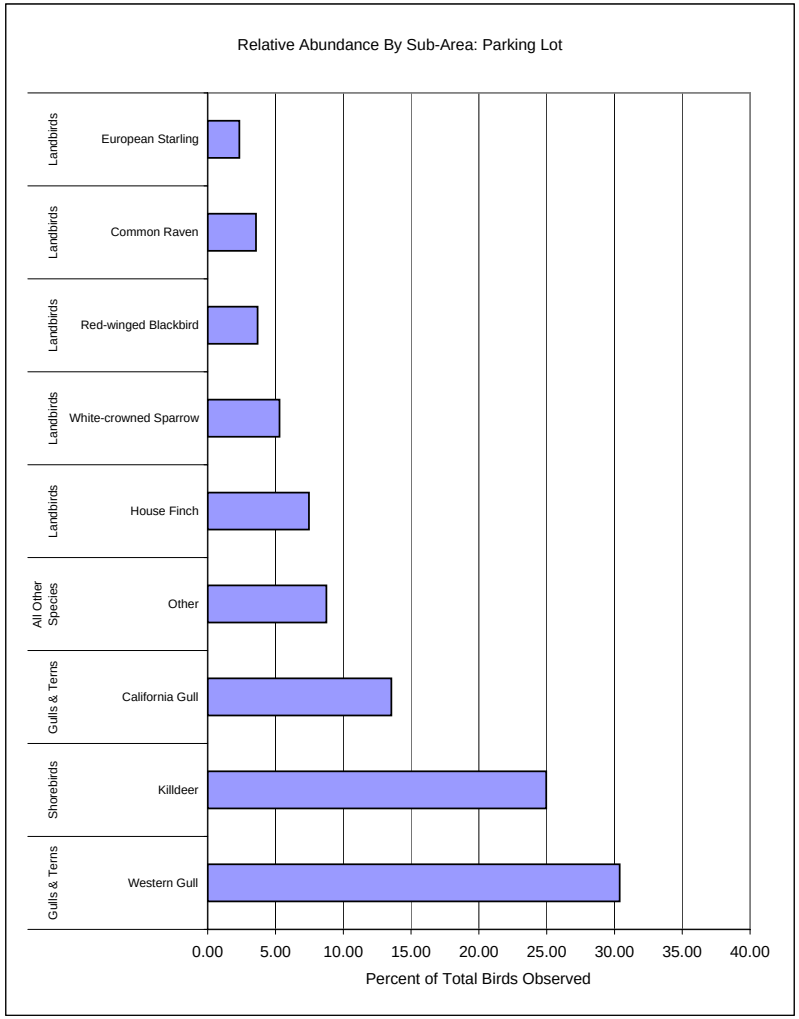
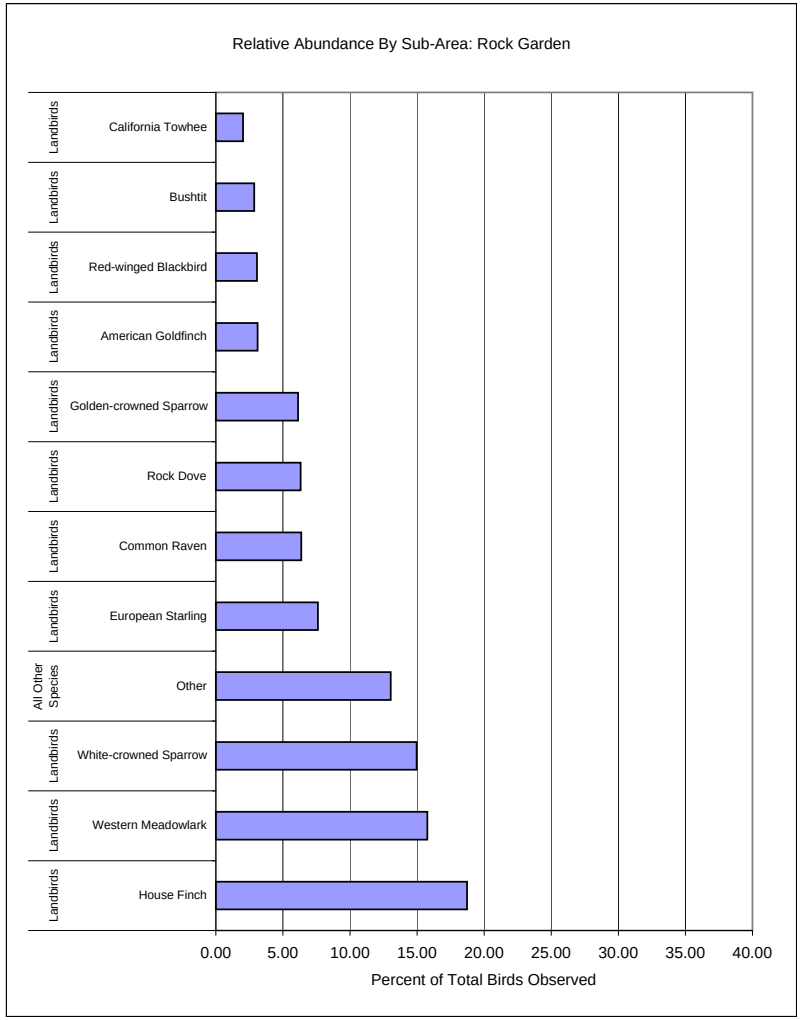


Figure 29-B4. Relative Abundance of Birds by Sub-Area (January 2003 through April 2004). Species comprising 2 percent or greater of the total number of birds observed in each sub-area are shown. Species comprising less than 2 percent of the total birds observed are combined and shown as "Other."



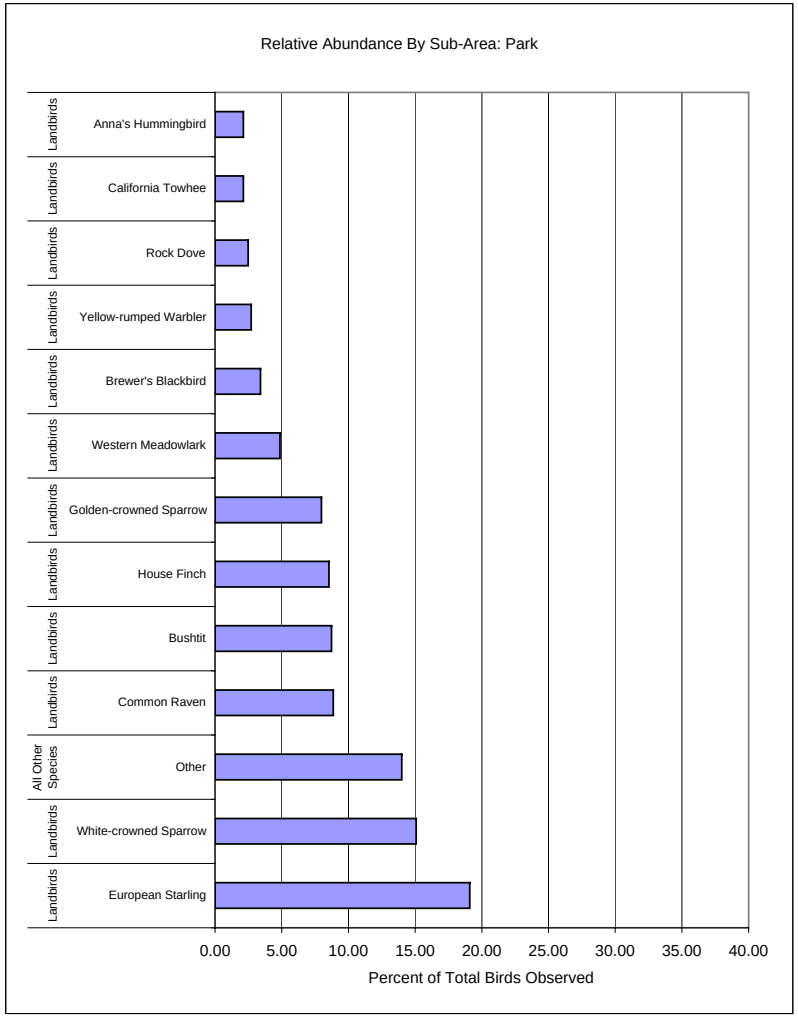


Figure 29-B5. Relative Abundance of Birds by Sub-Area (January 2003 through April 2004). Species comprising 2 percent or greater of the total number of birds observed in each sub-area are shown. Species comprising less than 2 percent of the total birds observed are combined and shown as "Other."