HYRDROGEN SULFIDE MONITORING AND THE EFFECTS OF OIL AND GAS ACTIVITITES ON MIGRATORY BIRDS IN SOUTHEASTERN NEW MEXICO

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ABSTRACT

This study examined the effects of hydrogen sulfide (H_2S), emitted by oil and gas activities, by focusing on migratory birds in southeastern New Mexico. Study sites were chosen in southeastern New Mexico near the cities of Roswell, Artesia, Clovis, and Carlsbad. H_2S monitors were routinely deployed in different locations within habitat affected by oil and gas activities for over one year. Data collection of H_2S concentrations began on November 6, 2002 and concluded on August 6, 2003. Concentrations of H_2S as high as 33 parts per million (ppm) were measured near an oil tank, near the town of Maljamar. Point count surveys of migratory birds were conducted to determine differences in habitat use of areas impacted by oil and gas activities. Point count survey results of migratory birds from undisturbed sites (areas without oil and gas activities within 250 meters) were compared with disturbed sites (areas affected by oil and gas activities). Point count surveys began on November 21, 2002 and concluded on August 6, 2003. There were statistically significant differences in the average number of avian individuals per point count, the average number of avian species per point count, the species diversity, and the average concentration of H_2S per point count at disturbed and undisturbed sites in southeast New Mexico.

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INTRODUCTION

The oil and gas extraction industry can be classified into four major processes: (1) exploration, (2) well development, (3) production, and (4) site abandonment (United States Environmental Protection Agency [USEPA] 1999; collectively, "oil and gas activities"). During production, petroleum is brought to the surface and separated into its liquid and gas components. Hydrogen sulfide is found naturally in large amounts in underground natural gas and petroleum reserves. During oil and gas activities any impurities, like natural gas, H_2S, water, sand, silt, and additives used to enhance extraction are removed or allowed to volatilize into the air. Crude oil is nearly always processed at a refinery to remove impurities, while natural gas may be processed to remove impurities either in the field or at a natural gas processing plant.

Hydrogen Sulfide (H_2S)

Hydrogen sulfide is corrosive and toxic; therefore, it is desirable to remove the H_2S and water as soon as possible during the conditioning process. Petroleum reserves have varying amounts of H_2S in them and those reserves that are H_2S-rich are termed "sour." The process of removing H_2S during refinement and conditioning for transport and home use is termed "sweetening." Each year, natural gas producers spend nearly $4 billion to improve gas quality, but gas has steadily become "dirtier" as lower quality resources have been developed (Smalley and Leppin 1998).

Organic matter always contains sulfur and wherever it undergoes putrefaction (such as at the bottom of a lake, deep underground, in piles of manure, decomposition, etc.), some of that sulfur is converted to H_2S. Nationally, the largest source of H_2S is from petroleum production activities (USEPA 1999). Hydrogen sulfide is soluble in water and oil, so it can move great distances before conditions favor its emergence as a vapor and because the vapor is heavier than air, it may creep along the ground for a distance before being neutralized by chemical reactions, ignited, or it can accumulate in low-lying areas in the environment (EPA 1999). Hydrogen sulfide is a colorless, flammable, and highly toxic gas, which often smells like rotten eggs.

In addition to H_2S emission during production and refining, the USEPA (1999) reported that accidental air releases through leaking tubing, valves, tanks, or open pits are another source of H_2S emissions to the environment. When natural gas is produced from the well that is not sold or used on-site, it is usually flared or vented, thereby releasing carbon monoxide, nitrogen oxides, H_2S, or sulfur dioxide to the atmosphere. During petroleum spills, H_2S gas volatilizes to the atmosphere before clean up. Natural gas wells and pipelines that rupture will emit methane and H_2S. As H_2S is heavier than air, it will sink into low-lying areas, where it can accumulate and concentrate.

In New Mexico, the Oil Conservation Division has rules and regulations regarding the emission of H_2S from any well or gas-producing facility (Energy, Minerals, and Natural Resources Department [EMNRD] 1996). These rules provide for the protection of the public's safety in

areas where H_2S concentrations are greater than 100 parts per million (ppm). Generally, any gas-processing facility where H_2S gas is present in concentrations of 100 ppm or more must take reasonable measures to forewarn and safeguard people that have occasion to be on or near the area. Wells drilled where there is substantial probability of people encountering H_2S gas in concentrations of 500 ppm or more have warning "poison gas" signs at the entrance. Facilities (except gas-processing plants) having storage tanks with H_2S gas in concentrations of 1,000 ppm or more have identifying signs indicating the specific protective measures that may be necessary to protect public safety. Any well, lease, or processing plant handling gas with a H_2S concentration and volume that equates to 10,000 cubic feet per day or more, which is located within one fourth of a mile of a dwelling, public place, or highway, must install safety devices and maintain them in operable conditions or they will establish safety procedures designed to prevent the undetected escape of H_2S as well as prepare a contingency plan for people's safe evacuation.

The United States Bureau of Land Management (BLM) has similar rules and regulations for well leases and facilities on BLM lands in New Mexico. The BLM identified areas or zones they manage for oil and gas production (along with other resource uses and goals) including the Mescalero Sands, where postings must occur and human entry must be accompanied by monitoring devices to reduce the risks to people from H_2S exposure (BLM 1997). The BLM has identified, mapped, and posted signs in areas where elevated H_2S releases from oil and gas wells are known to occur that may pose risks to human health and safety. However, no Federal or State rules identify or address the risks to wildlife from H_2S emissions from oil and gas activities.

Most gas emissions can be minimized through prevention (e.g., preventive maintenance and monitoring, inspections, leak detection, installing catalytic converters, filters, sponges, replacement of gaskets, seals, valves, tightening connections, and welding, as well as educating and informing the workforce). Flaring or burning off gases may is sometimes used to reduce air emissions that are unavoidable or are too small to warrant the cost of capture. Nearly all production wells are equipped with a vent and flare to release unusual pressure, and some wells that produce only a small amount of natural gas will vent or flare it when there is no on-site use for the gas (e.g., to power engines) and no pipeline nearby to transport the gas to market. Since natural gas has economic value, flaring is usually a last resort. When a gas is flared, it passes through the vent away from the well, and is burned in the presence of a pilot light. Although it is preferable to prevent the emission in the first place, flaring has benefits over simple venting of unburned material. Not all wells in southeastern New Mexico practice flaring. Flaring also produces sulfur dioxide, which is a global atmospheric contaminant of concern.

Data on the effects of H_2S are only well documented for common test animals and humans. The following human information was included because the mechanism of H_2S toxicity is considered to be common among all vertebrates that utilize aerobic pathways of metabolism (TOXLINE 2003). The characteristics of acute H_2S toxicity are dependent on the concentration and duration of exposure. Exposure is usually by inhalation. At high concentrations (500-1,000 ppm), H_2S acts as a systemic poison, causing unconsciousness and death by respiratory paralysis (TOXLINE 2003). After inhalation, H_2S enters the circulation directly across the alveolar-capillary membrane where it dissociates into a sulfide ion. The sulfide ion is then selectively

taken up by the mammal brainstem where it interferes with neurotransmitter levels. The sulfide ion also reversibly interacts with a number of enzymes, proteins, and other macromolecules including hemoglobin and myoglobin. The critical target of the sulfide ion is the cytochrome-oxidase enzymes, but particularly Cytochrome-C Oxidase, which results in the inhibition of cellular utilization of oxygen, which leads to metabolic acidosis secondary to anaerobic metabolism, then to cytotoxic anoxia, and finally, cell death (TOXLINE 2003). Hydrogen sulfide is a more potent Cytochrome-C Oxidase inhibitor than is cyanide (Smith 1991). As a cellular poison, the effects of H_2S are seen across all organ systems and would be expected to behave similarly in all vertebrate wildlife species that utilize aerobic metabolism such as in migratory birds, mammals, reptiles, and amphibians.

The health effects of chronic, low-level exposure to H_2S are not well defined. Exposure to H_2S concentrations of 15-100 ppm may cause eye irritation and conjunctivitis ("gas eye"), convulsions, and also pulmonary edema (Lopez *et al.* 1989). At low concentrations (10 to 25 ppm), people report flu-like symptoms including headaches, dizziness, nausea, vomiting, irritation of the eyes, nose, and throat, fatigue, insomnia, and digestive disturbances (National Institute for Occupational Safety and Health [NIOSH] 1977). Long term damage and death in small animals occurs when H_2S gas levels exceed 50-100 parts per million (ppm) (Dahme *et al.* 1983). At higher concentrations (250-500 ppm), H_2S acts as a respiratory irritant, which can lead to a pulmonary edema (TOXLINE 2003).

The odor threshold for humans begins at 0.003-0.3 ppm, is easily perceptible at 1 ppm, and is reminiscent of rotten eggs at 3-30 ppm. A sickeningly sweet odor is described from 30-100 ppm above which rapid olfactory fatigue and paralysis ends perception. Prolonged exposure to lower concentrations may also result in olfactory paralysis or nasal membrane necrosis. The smell of H_2S is not a reliable warning for dangerous concentrations (TOXLINE 2003). Individuals exposed to chronic air concentrations and then evacuated to clean air will recover with no ill effects (TOXLINE 2003).

Study Area

The study area includes portions of Chaves, Eddy, and Lea Counties in southeastern New Mexico (Figure 1). The study area includes portions of the Mescalero Sands, an extensive deep-sand dune area west of the Caprock, south of State Highway 70, north of State Highway 31, and east of the Pecos River. Portions of the Mescalero Sands have been designated as a National Natural Landmark, an Outstanding Natural Area, and a Research Natural Area (BLM 1997). Hawley (1986) identified this area as part of the Great Plains Province, while Dick-Peddie (1993) further identified this area as Plains-Mesa Sand Scrub due to the presence of shin-oak (*Quercus havardii*). This region contains the petroleum resources of the Permian Basin that produce annually about 65 million barrels of crude oil and natural gas, providing more than 5,500 jobs and associated revenue (EMNRD 2000).

There is a community of plants and animals called a sand shinnery associated with the Mescalero Sands (Peterson and Boyd 1998). Shin-oaks co-dominate the sand shinnery vegetative community along with tall grasses and forbs. Sand shinnery communities comprise the largest stand of oak in the U.S. and occupy nearly six million acres in northern Texas, western

Oklahoma, and southeast New Mexico. This shin-oak forest is only 1 to 4 feet tall and is composed of ancient plants, most of them hundreds to thousands of years old (Peterson and Boyd 1998). Two species of wildlife characteristic of the sand shinnery community are the lesser prairie chicken (*tympanuchus pallidicinctus)*, known for its courtship rituals, and the sand dune lizard (*sceloporus arenicolus*). Both are candidates for Federal listing under the Endangered Species Act (ESA). Common migratory bird species of the study area were described by Peterson and Boyd (1998). These include mourning dove (*Zenaida macroura*), scaled quail (*Callipepla squamata*), and common roadrunner (*Geococcyx californianus*) (Table 4 for other species found in the area, including scientific and common names).

Avian Survey Objectives

Very few studies have measured natural or accidental exposure of wildlife to H_2S. In this study, we quantified the concentrations of H_2S in the environment using stationary and hand-held monitors. Few studies have been conducted on the habitat usage by migratory birds of areas impacted by oil and gas activities in southeast New Mexico. To help correlate H_2S data, point count surveys of migratory birds were conducted to determine differences in habitat use of areas impacted by oil and gas activities.

Point counts are one of several methods of inventorying and monitoring birds. A point count is a total of all the birds detected visually and aurally by an observer from a fixed station during a fixed period of time. Various methods have been employed and thoroughly tested (Ralph *et al.* 1993). Other techniques include nest monitoring, capture-recapture with mist nests, counts on line transects, and spot mapping. The point count is probably the best method for most surveys and has been adopted as the standard method for monitoring birds (Huff *et al.* 2000).

Extensive point counts are intended for a series of points, placed at a minimum of 250 meters apart, largely on roads or trails over an entire region and intensive point counts are placed within a mist net or nest search plot (Hammel *et al.* 1996). An extensive point count route should include all the habitats of a region, if possible (Ralph *et al.* 1991). In choosing a survey route and laying out the points for a census, the use of a systematic rather than random sampling design, either on roads or off roads, is preferred. Systematic placement often includes placing points at designated distances along roads or trails (Ralph 1993).

Although a road modifies the surrounding habitats, many researchers feel that tertiary road systems allow birds to be counted in approximately the same proportions as off-road surveys (Ralph *et al.* 1991). In virtually all habitats, more than 99 percent of individuals are detected within 125 m of the observer (Thompson 2002). The minimum distance between point counts in wooded habitats is 250 meters and 1000 meters in open habitats (Smith *et al.* 1993). Point counts last for either 5 or 15 minutes depending on the distance between survey sites, the amount of time available for point counts, and the type of habitat survey sites are in (Ralph *et al.* 1993). The size of the point count survey site ranges from a circle with a radius of 25 to 50 meters (Thompson 2002). The use of two observers for point counts increases the accuracy of the results (Nichols *et al.* 2000). The use of point counts was used to measure the effects of oil and gas activities on migratory birds.

METHODS

To monitor H_2S, accurate to within one ppm, monitors (Odalog H2S Gas Logger, App-Tek Internatinal Pty. Ltd., Munich, Germany) were deployed in 17 different locations within a variety of habitats. Monitors were deployed in areas that were considered "disturbed" if they were within 25 meters of oil pads, drill rigs, oil storage tanks, or oil pumps and in areas that were considered "undisturbed" if they were at least 250 meters from oil pads, oil wells, oil tanks, or oil processing facilities. The monitors were placed within 1-10 meters of this equipment for disturbed sites and within areas that were at least 250 meters from oil pads, oil wells, oil tanks, or oil processing facilities for undisturbed sites. The H_2S monitors contained a data logger within them that recorded the H_2S concentration once every minute. The monitors were rotated every two to four weeks to a new site. Data collection of H_2S concentrations began on November 6, 2002 and concluded on August 6 2003. Monitors were calibrated according to manufacture's specifications, and was later downloaded and then imported into a spread sheet.

Bird surveys were conducted using point counts. Point count surveys began on November 21, 2002 and concluded on August 6, 2003. Surveys were conducted along tertiary roads. A systematic gridding of points along roads were implemented. A randomization program was used to choose these tertiary roads among those available. The distance between point count locations was set at 1000 meters due to the openness of the habitat. Counts lasted three minutes and survey sites consisted of a circle with a radius of 50 meters. An initial test testing the differences in results from three and five minute point count surveys of similar habitat showed no differences (t-test, $P = 0.69$). Once the survey started, all birds that were seen or heard within the point count circle were recorded. The total number of birds, total number of species, and total number of individuals of each species were recorded. The average concentration of H_2S was also recorded with a handheld monitor (H_2S monitor, Models HS560, Industrial Scientific, Oakdale, Pennsylvania).

Data were evaluated according to habitat type (undisturbed or disturbed) and season. In each data set the number of birds, the number of species, and the number of individuals of each species were summed. Then the average number of birds per point count, the average number of species per point count, the average number of individuals of each species per point count, and the average concentration of H_2S gas per point count location were calculated. Differences between the average number of birds per point count, the average number of species per point count, and the average concentration of H_2S gas at the disturbed sites and the undisturbed sites were determined with the use of t-tests (Schefler 1969). Differences between the average numbers of individuals of each species per point count were determined with the use of a rXc contingency table (Schefler 1969). The statistical threshold of acceptability that was used was $P \leq 0.05$ (Schefler 1969).

RESULTS

Long term Hydrogen sulfide monitors were placed to monitor H_2S concentrations at 7 oil pumps and 8 oil tanks for periods averaging 2 to 3 weeks at a time (Figures 2 through 17). The average concentrations of H_2S measured ranged from 3 to 5 ppm. The highest concentration of 33 ppm was measured near an oil tank (North 32° 49' 54" by West 104° 02' 41") for a period lasting about an hour. A concentration of 27 ppm was measured at an oil tank (North 32° 36' 48" by West 103° 18' 44") for a period of 2 hours (Figure 13). H_2S monitors were placed twice in habitat that was unaffected by oil and gas activities and the average concentration of H_2S at these two areas was 0 ppm.

During the winter survey season, a total of 52 point count surveys of birds were conducted on undisturbed sites and 50 point count surveys were conducted on disturbed sites. A total of 198 birds representing 34 species were counted on undisturbed sites and 40 birds representing 19 species were counted on disturbed sites (Table 1, Figure 18). The average number of individuals counted per point count survey at the undisturbed sites was 3.8 (Standard Deviation [S.D.] = 4.4). The average number of individuals counted per point count survey at the disturbed sites was 0.8 (S.D. = 1.3). The observed difference in the average number of individuals at the undisturbed and disturbed sites was statistically significant (t-test, $P < 0.01$). The average number of species counted per point count survey at the undisturbed sites was 1.3 (S.D. = 1.2) and 0.5 (S.D. = 0.7) at the disturbed sites. Also the difference in the average number of species counted per point count at the undisturbed and disturbed sites was statistically significant (t-test, $P < 0.01$). The observed differences in species composition at the undisturbed and disturbed sites were statistically significant (rXc contingency table, $P < 0.01$). The average concentration of H_2S present at the undisturbed sites was 0.1 ppm (S.D. = 0.3) and at the disturbed sites was 1.5 (S.D. = 0.7). The observed difference was statistically significant (t-test, $P < 0.01$).

During the spring survey season a total of 42 point count surveys of birds were conducted on undisturbed sites and 33 point count surveys were conducted on disturbed sites. A total of 62 birds representing 15 species were counted on undisturbed sites and 6 birds representing 4 species were counted on disturbed sites (Table 2, Figure 19). The average number of individuals counted per point count survey at the undisturbed sites was 1.5 (S.D. = 1.4) and 0.2 (S.D. = 0.5) at the disturbed sites. The observed difference in the average number of individuals was statistically significant (t-test, $P < 0.01$). The average number of species counted per point count survey at the undisturbed sites was 0.9 (S.D. = 0.1) and 0.2 (S.D. = 0.1) at the disturbed sites. The observed difference was statistically significant (t-test, $P < 0.01$). The observed differences in species composition at the undisturbed and disturbed sites were statistically significant (rXc contingency table, $P < 0.01$). The average concentration of H_2S at the undisturbed sites was 0.2 ppm (S.D. = 0.5) and 1.2 ppm (S.D. = 0.6) at the disturbed sites. The observed difference was statistically significant (t-test, $P < 0.01$).

During the summer survey season a total of 26 point count surveys of birds were conducted on undisturbed sites and 33 point count surveys were conducted on disturbed sites. A total of 54

birds representing 15 species were counted on undisturbed sites and 15 birds representing 5 species were counted on disturbed sites (Table 3, Figure 20). The average number of individuals counted per point count survey at the undisturbed sites was 2.1 (S.D. = 2.3) and 0.5 (S.D. = 0.8) at the disturbed sites. The observed difference in the average number of individuals was statistically significant (t-test, $P < 0.01$). The average number of species counted per point count survey at the undisturbed sites was 0.9 (S.D. = 0.1) and 0.3 (S.D. = 0.5) at the disturbed sites. The observed difference was statistically significant (t-test, $P < 0.01$). The observed differences in species composition at the undisturbed and disturbed sites were statistically significant (rXc contingency table, $P < 0.01$). The average concentration of H_2S at the undisturbed sites was 0.3 ppm (S.D. = 0.5) and 2.0 ppm (S.D. = 1.6) at the disturbed sites. The observed difference was statistically significant (t-test, $P < 0.01$).

Overall a total of 120 point count surveys of birds were conducted on undisturbed sites and 116 point count surveys were conducted on disturbed sites. A total of 314 birds representing 40 species were counted on undisturbed sites and 58 birds representing 25 species were counted on disturbed sites (Table 4, Figure 21). Lesser prairie chickens were not observed at any of the sites. The average number of individuals counted per point count survey at the undisturbed sites was 2.6 (S.D. = 3.3) and 0.5 (S.D. = 0.9) at the disturbed sites. The observed difference was statistically significant (t-test, $P < 0.01$). The average number of species counted per point count survey at the undisturbed sites was 1.1 (S.D. = 0.9) and 0.4 (S.D. = 0.6) at the disturbed sites. The observed difference was statistically significant (t-test, $P < 0.01$). The observed differences in species composition at the undisturbed and disturbed sites were statistically significant (rXc contingency table, $P = 0.04$). The average concentration of H_2S at the undisturbed sites was 0.2 ppm (S.D. = 0.4) and 1.6 ppm (S.D. = 1.1) at the disturbed sites. The observed difference was statistically significant (t-test, $P < 0.01$).

DISCUSSION, CONCLUSION, & RECOMMENDATIONS

Studies have found that habitat disrupted by oil and gas activities negatively impacts populations of birds. Migration routes of waterfowl are often changed and the breeding success of waterfowl decreases as a result of oil and gas activities (Johnson 1998 and Monda *et al.* 1994). Populations of birds of prey dramatically decrease when oil wells are placed within habitat they occupy (Squires *et al.* 1993 and Van Horn 1993). Many species of passerines have also been impacted negatively by the building of oil well sites (Baker 1987).

While the concentrations of H_2S that effect mammals have been studied, the concentrations of H_2S that effect avian species are relatively unknown. Siegel and others (1986) examined ambient levels of H_2S at Sulphur Bay Wildlife Area in New Zealand, where shorebirds were exposed to concentrations of 0.125 to 3.90 ppm. They found fewer species of birds used this habitat compared to similar wetlands without detectable levels of H_2S. The authors suggested that the exposure of these birds was higher than would be expected for similar size mammals because small birds have a higher utilization rate of oxygen and therefore a higher ventilization rate. The Canadian Wildlife Service also conducted a study of the effects of a gas well blow out in Alberta, Canada on wildlife (New Norway Scientific Committee, 1974). Concentrations between 5 and 10 ppm were documented and birds and small animals were absent from the study area after the blowout (New Norway Scientific Committee, 1974). This suggests that low concentrations of H_2S, as low as 5 to 10 ppm, negatively affects habitat usage by avian species. This study measured concentrations of H_2S as high as 33 ppm near oil and gas activities.

There was a statistical difference in the average number of individuals counted per point count, the average number of species counted per point count survey, the species composition, and the average concentration of H_2S at the undisturbed and disturbed sites. This suggests that habitat quality may be affected by oil and gas activities and may alter the composition of avian populations. Habitat disrupted by oil and gas activities favored avian species adapted to feeding in disturbed habitat such as doves, quail, and sparrows. Habitat disturbed by oil and gas activities contains fewer species and reduced usage by habitat specialists such as the lesser prairie chicken, yellow billed cuckoo, and burrowing owl.

CONCLUSION

Oil and gas activities appear to have negatively affected migratory birds and numbers. Habitat loss and releases of H_2S, both caused by oil and gas activities, were significantly correlated with reducing populations of birds as well as decreasing species diversity.

RECOMMENDATIONS

Further long term studies of the effects of oil and gas activities on habitat usage by migratory birds are needed. Restoration of habitat affected by activities of oil and gas is needed to preserve migratory bird populations and species diversity.

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Figure 8. Graph of Hydrogen Sulfide Concentrations Near an Oil Storage Tank (North 32° 50' 37" by West 104° 02' 37") for January 7, 2003- January 23, 2003.

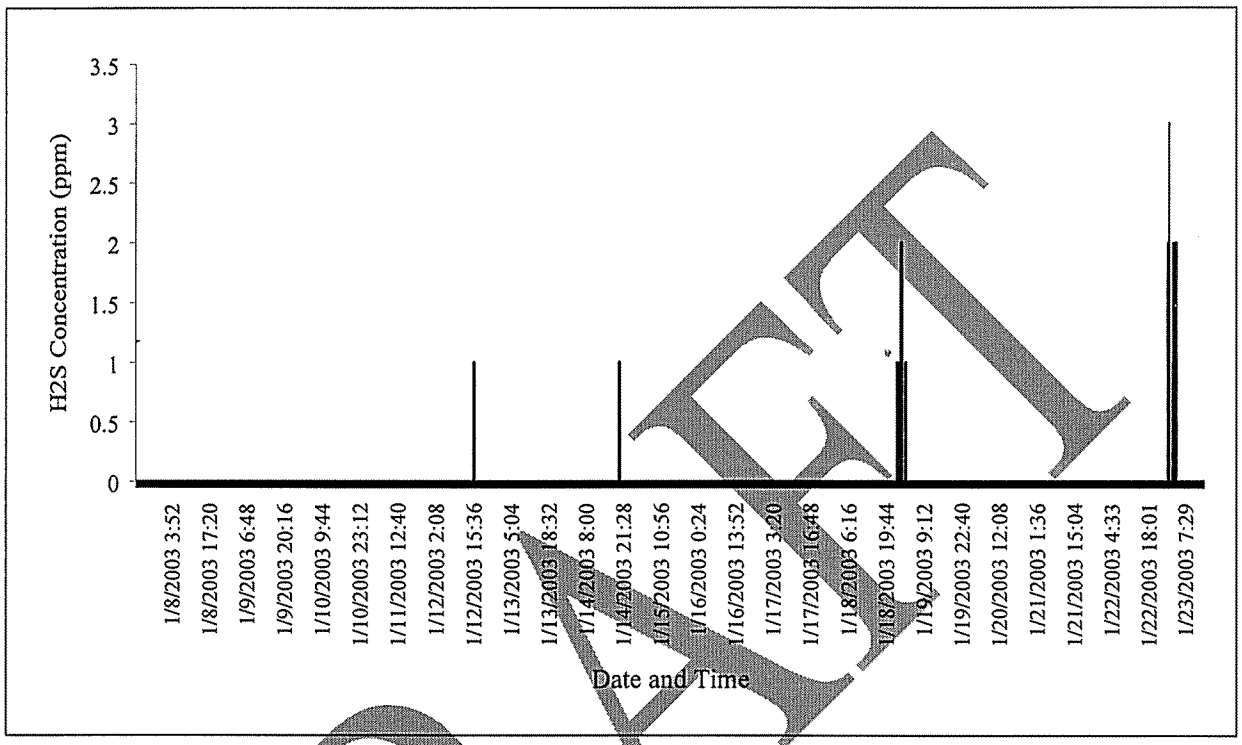

Figure 9. Graph of Hydrogen Sulfide Concentrations Near an Oil Well (North 32° 31' 01" by West 103° 16' 59") for January 7, 2003- January 23, 2003.

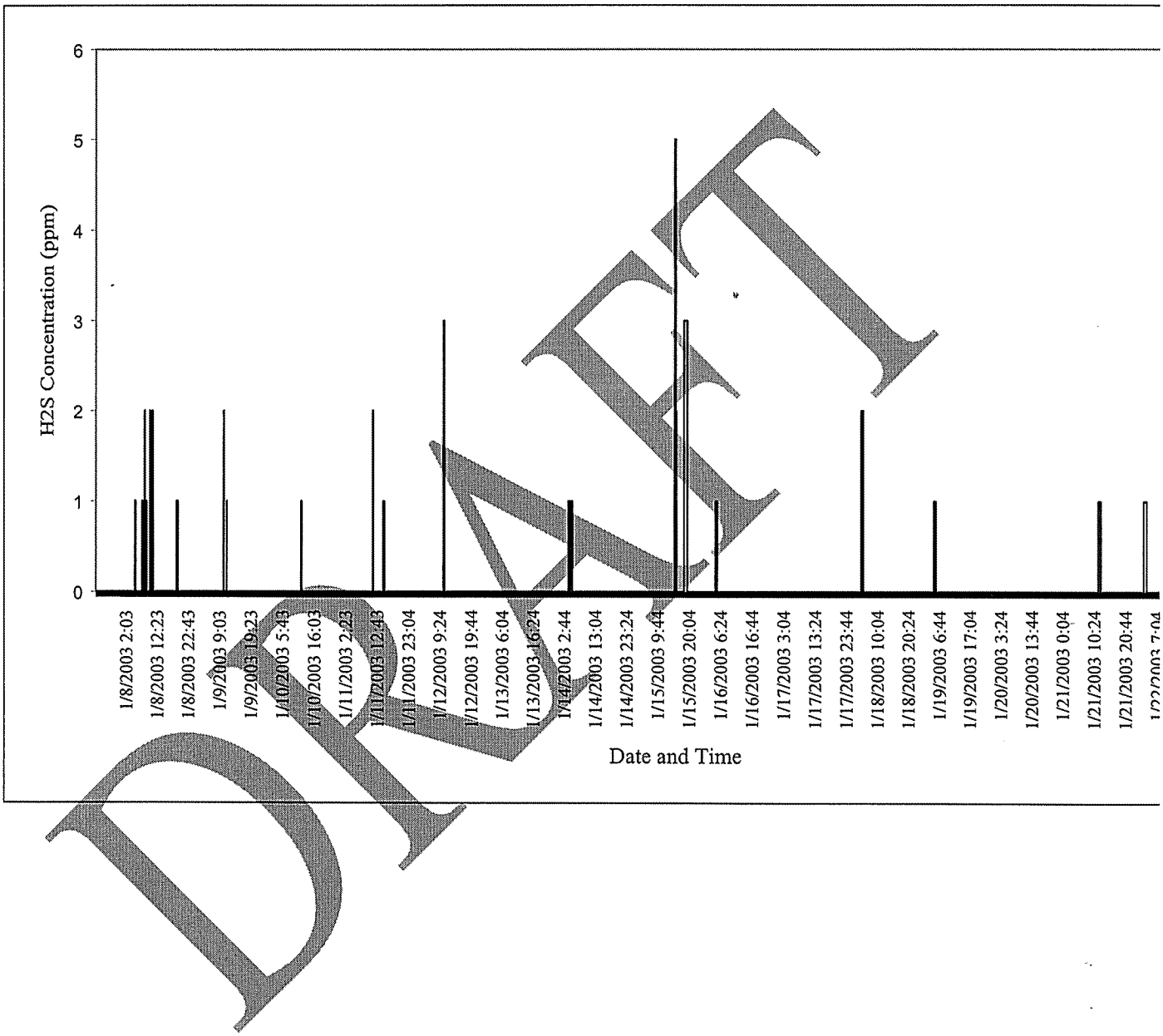

Figure 10. Graph of Hydrogen Sulfide Concentrations Near an Oil Storage Tank (North 32° 36' 48" by West 103° 18' 44") for January 23, 2003- February 11, 2003.

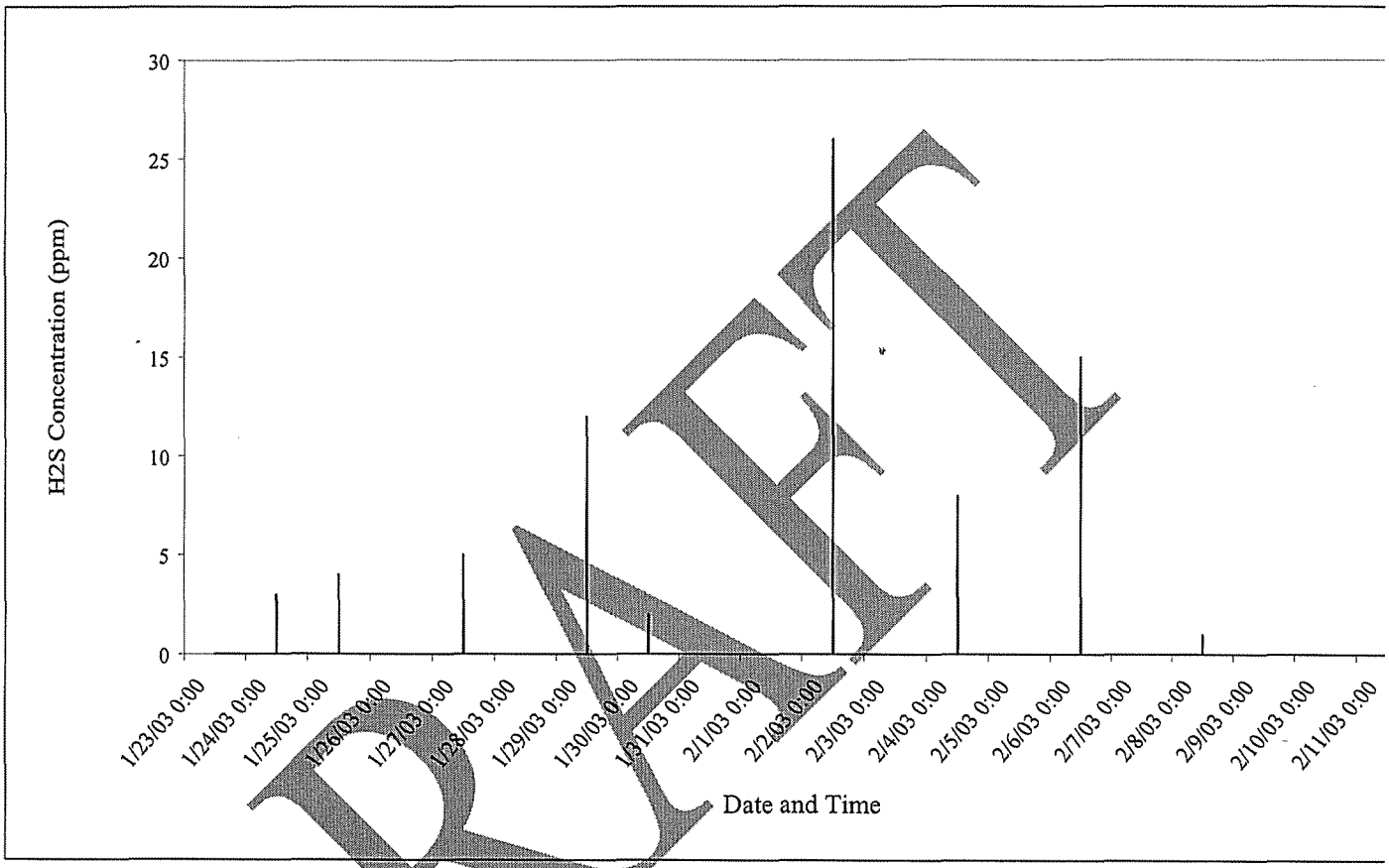

Figure 11. Graph of Hydrogen Sulfide Concentrations Near an Oil Well (North 32° 51' 46" by West 104° 04' 16") for January 23, 2003- February 11, 2003.

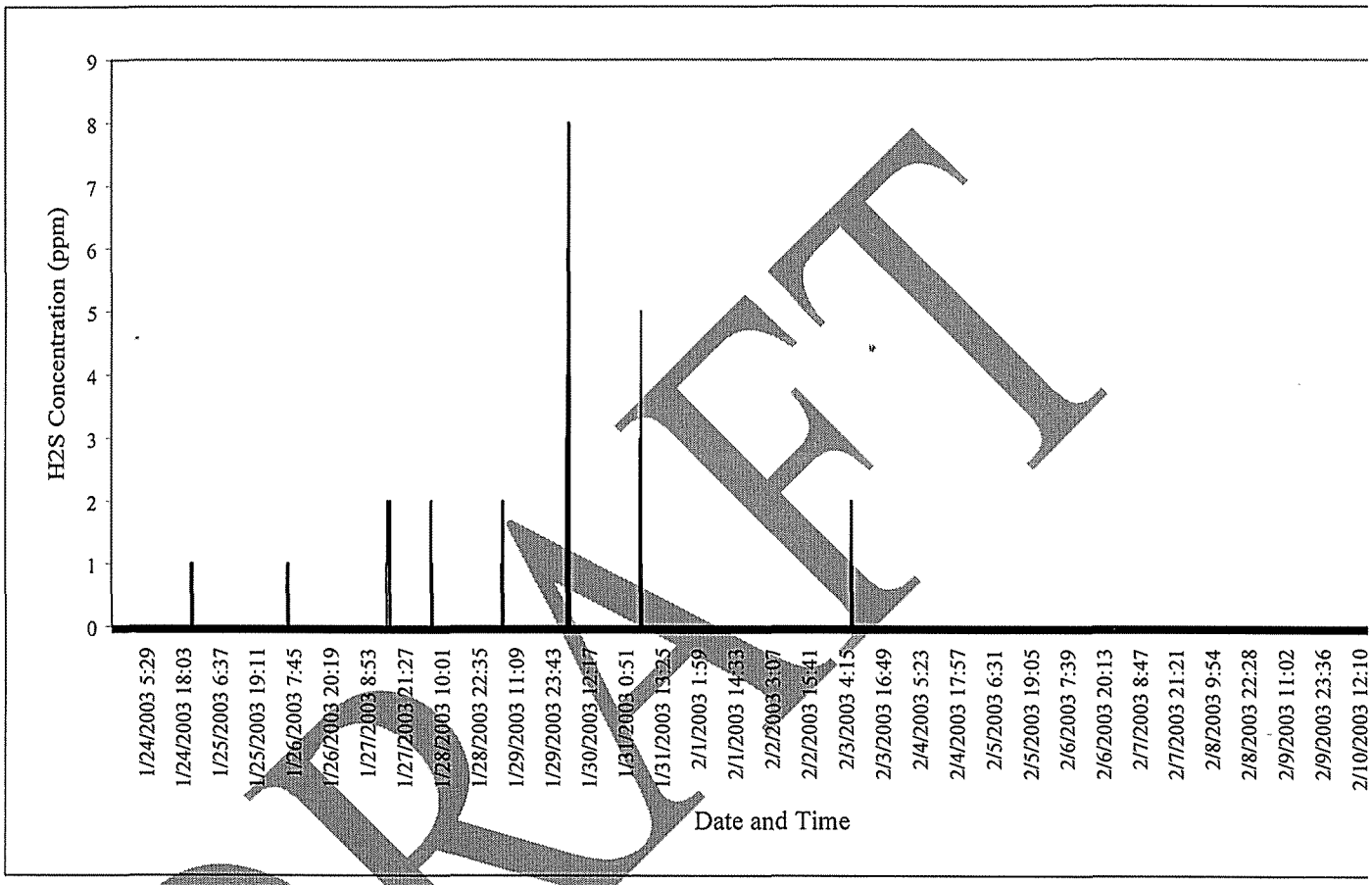

Figure 12. Graph of Hydrogen Sulfide Concentrations Near an Oil Storage Tank (North 32° 52' 43" by West 104° 04' 32") for March 4, 2003- April 16, 2003.

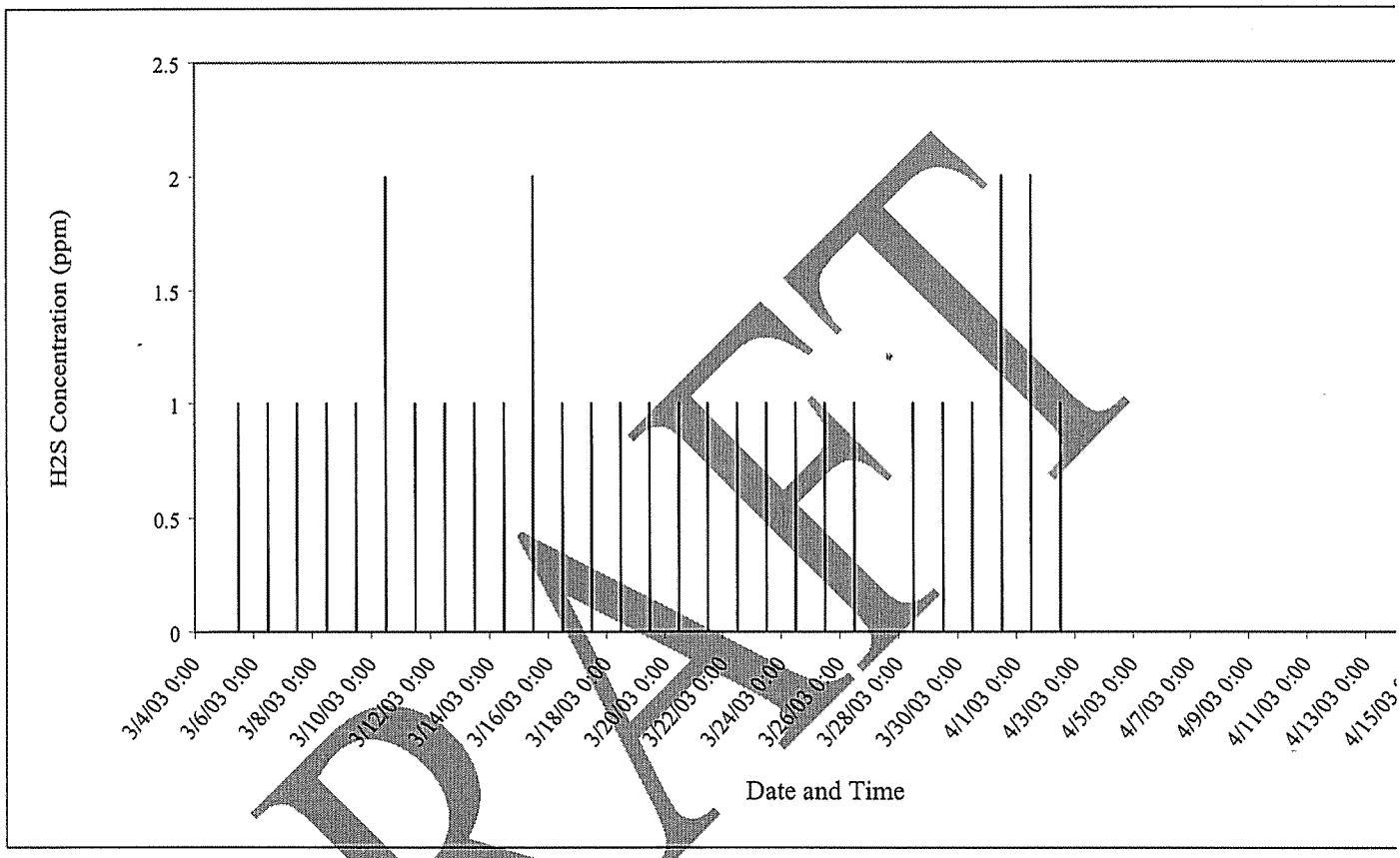

Figure 13. Graph of Hydrogen Sulfide Concentrations Near an Oil Well (North 32° 49' 54" by West 104° 02' 41") for March 4, 2003- April 16, 2003.

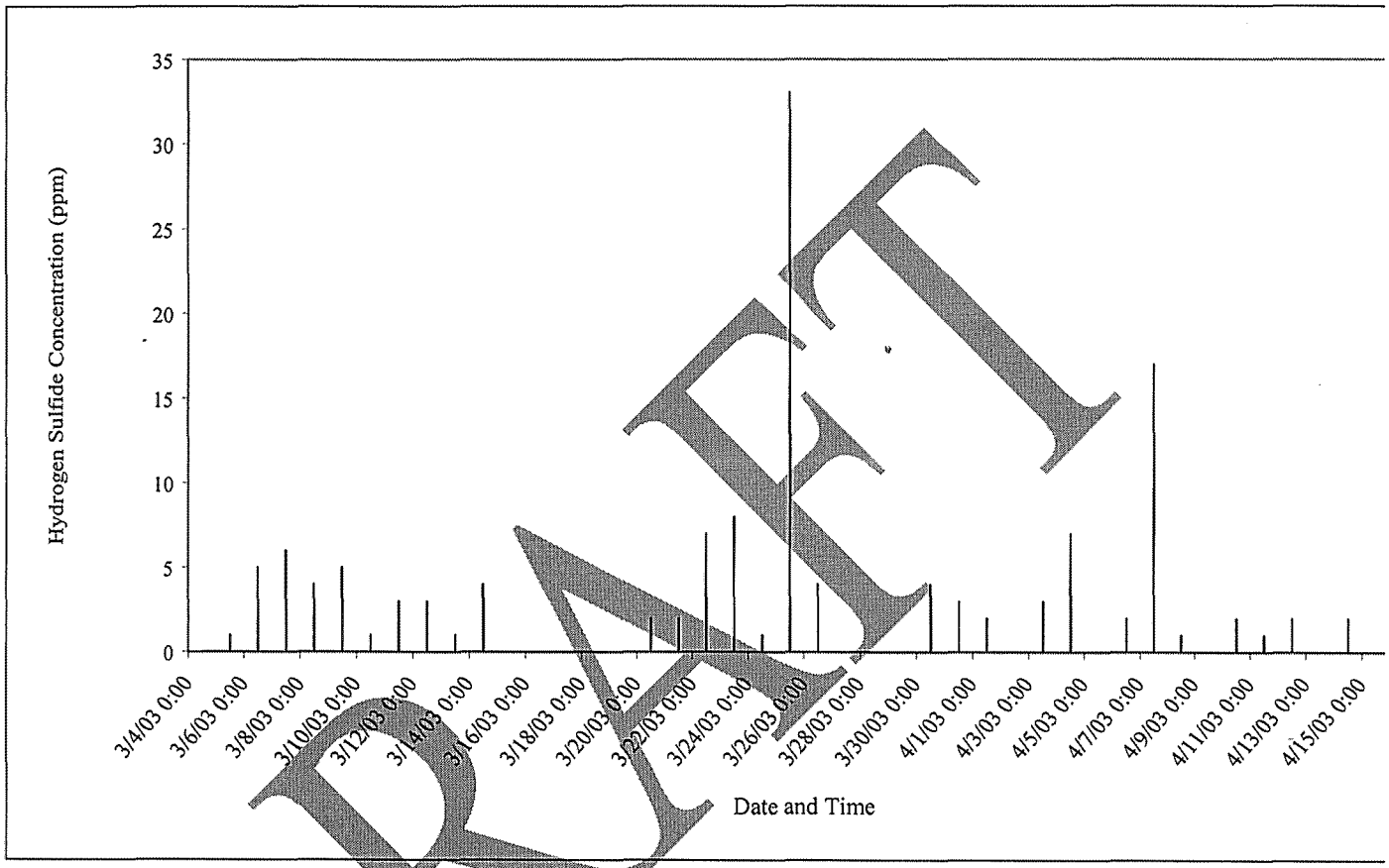

Figure 14. Graph of Hydrogen Sulfide Concentrations Near Mathers Natural Area (North 32° 48' 14" by West 103° 56' 27") for April 23, 2003- June 28, 2003.

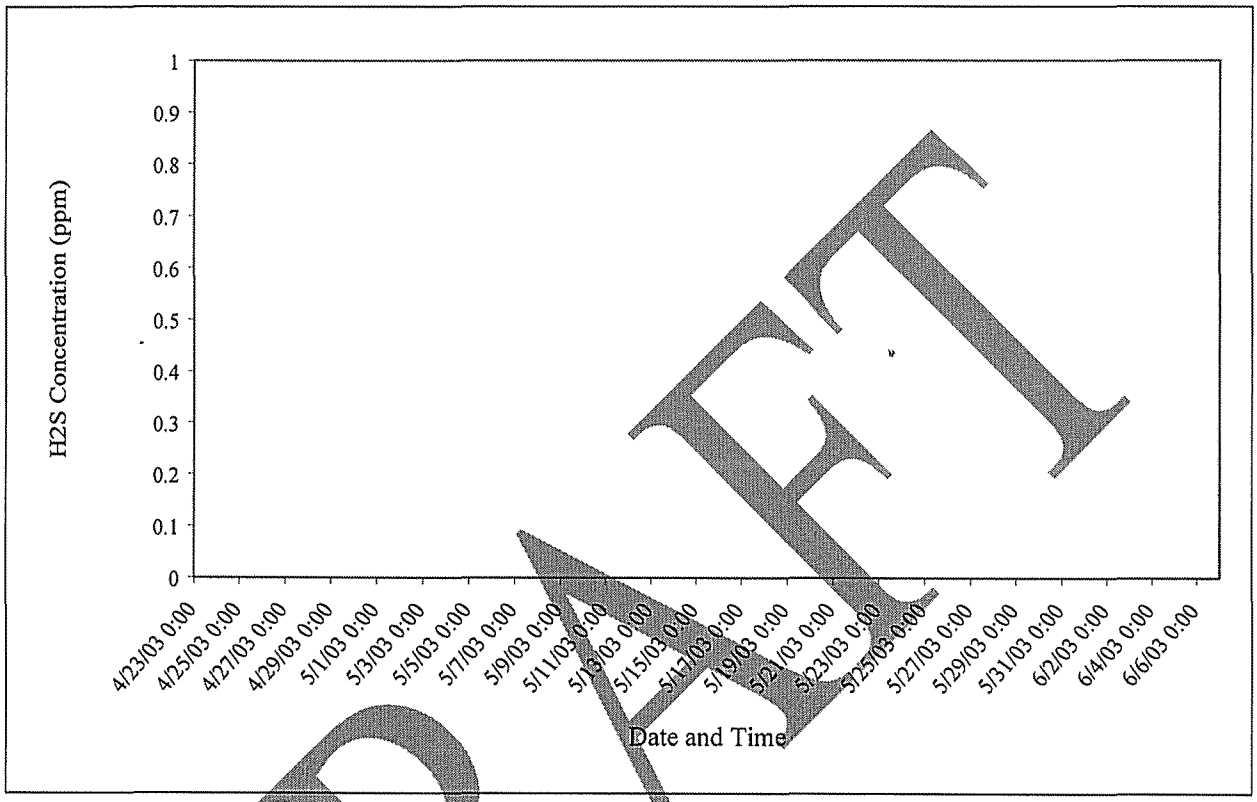

Figure 15. Graph of Hydrogen Sulfide Concentrations Near an Oil Well (North 32° 42' 21" by West 103° 46' 12") for April 23, 2003- June 28, 2003.

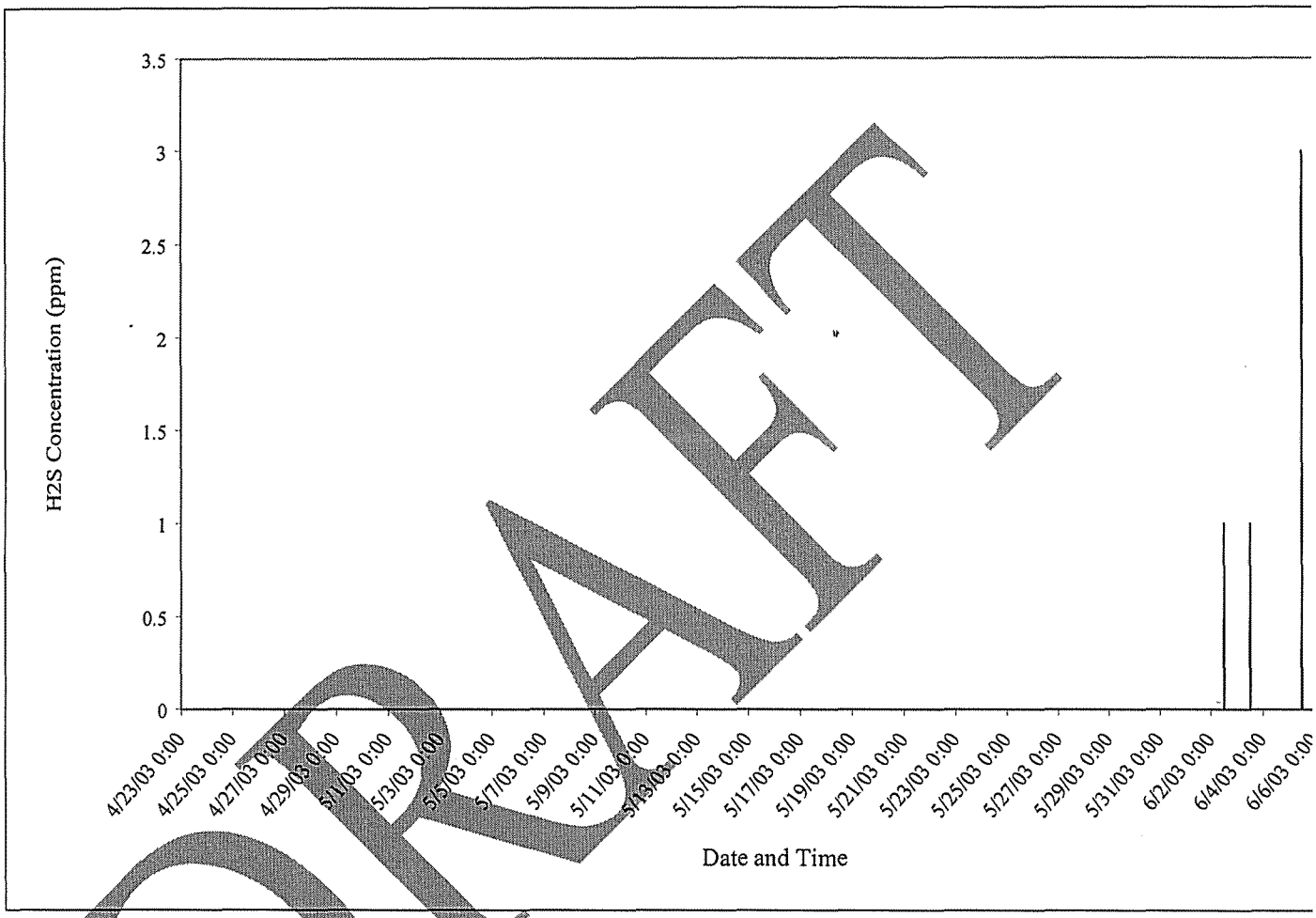

Figure 16. Graph of Hydrogen Sulfide Concentrations Near an Oil Storage Tank (North 32° 48' 10" by West 103° 45' 31") for June 28, 2003- August 6, 2003.

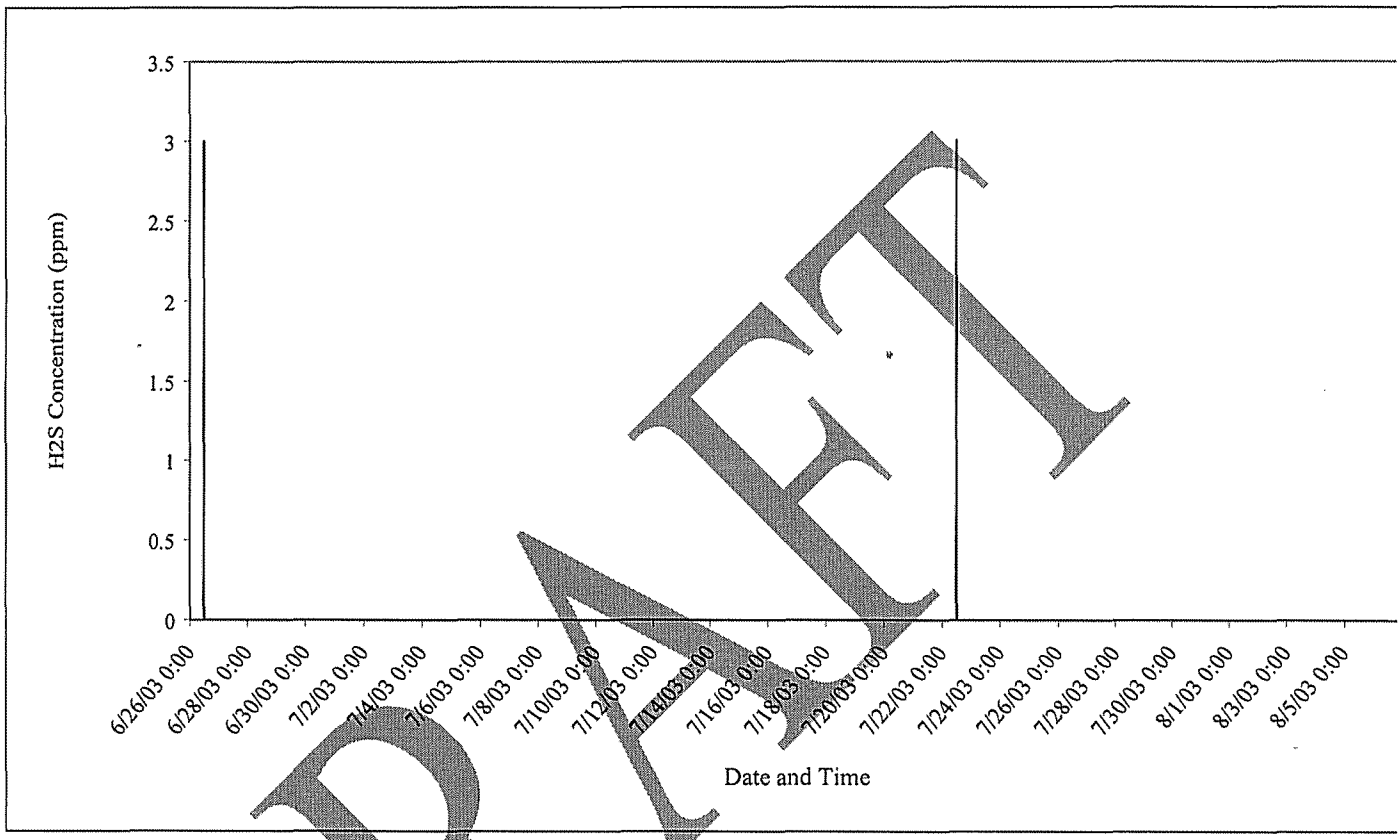

Figure 17. Graph of Hydrogen Sulfide Concentrations Near an Oil Well (North 32° 45' 16" by West 103° 36' 39") for June 28, 2003- August 6, 2003.

Figure 18. Graph of Species Composition Present at Undisturbed and Disturbed Sites for the Winter Survey Season.

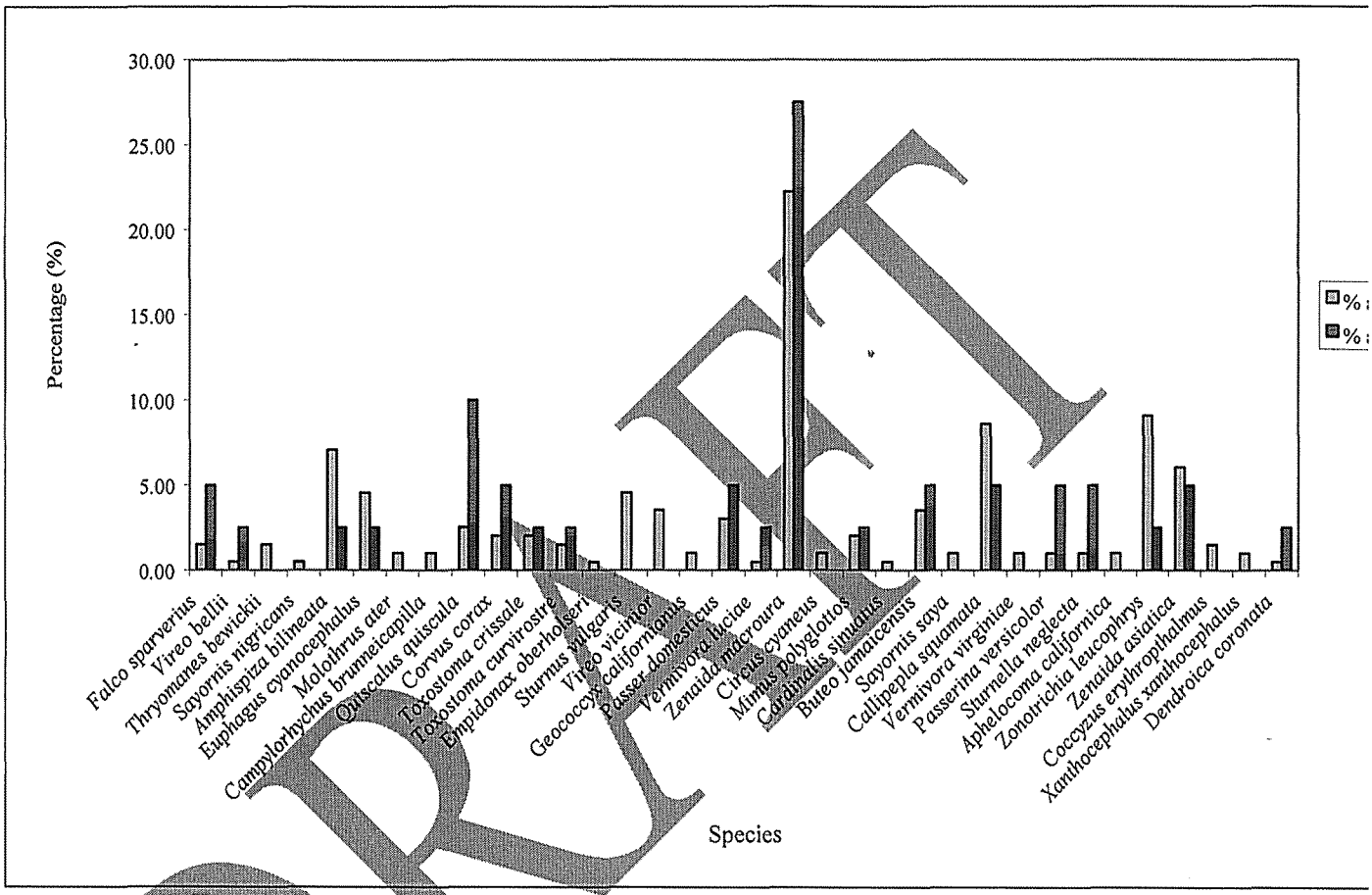

Figure 19. Graph of Species Composition Present at Undisturbed and Disturbed Sites For the Spring Survey Season.

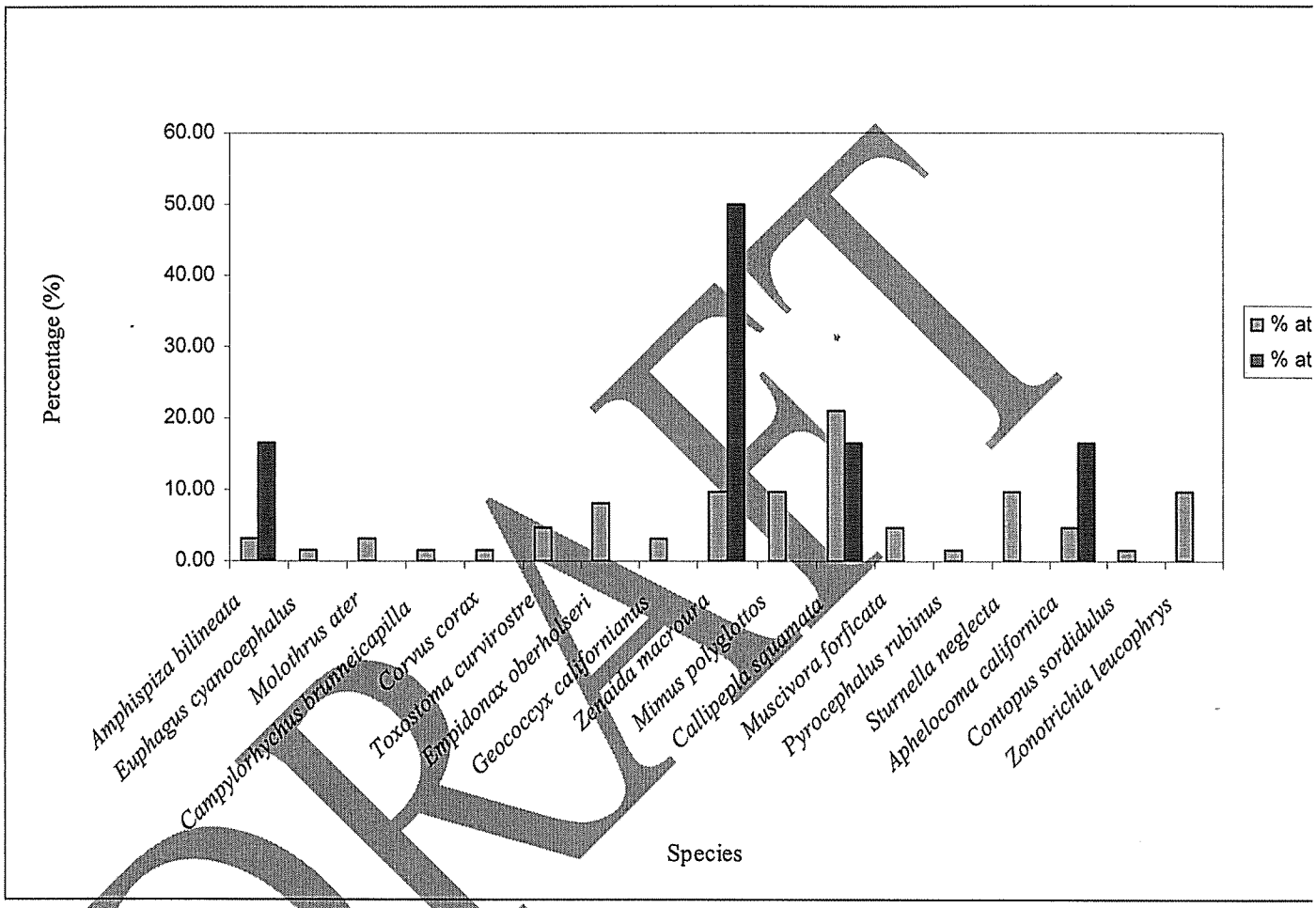

Figure 20. Graph of Species Composition Present at Undisturbed and Disturbed Sites For the Summer Survey Season.

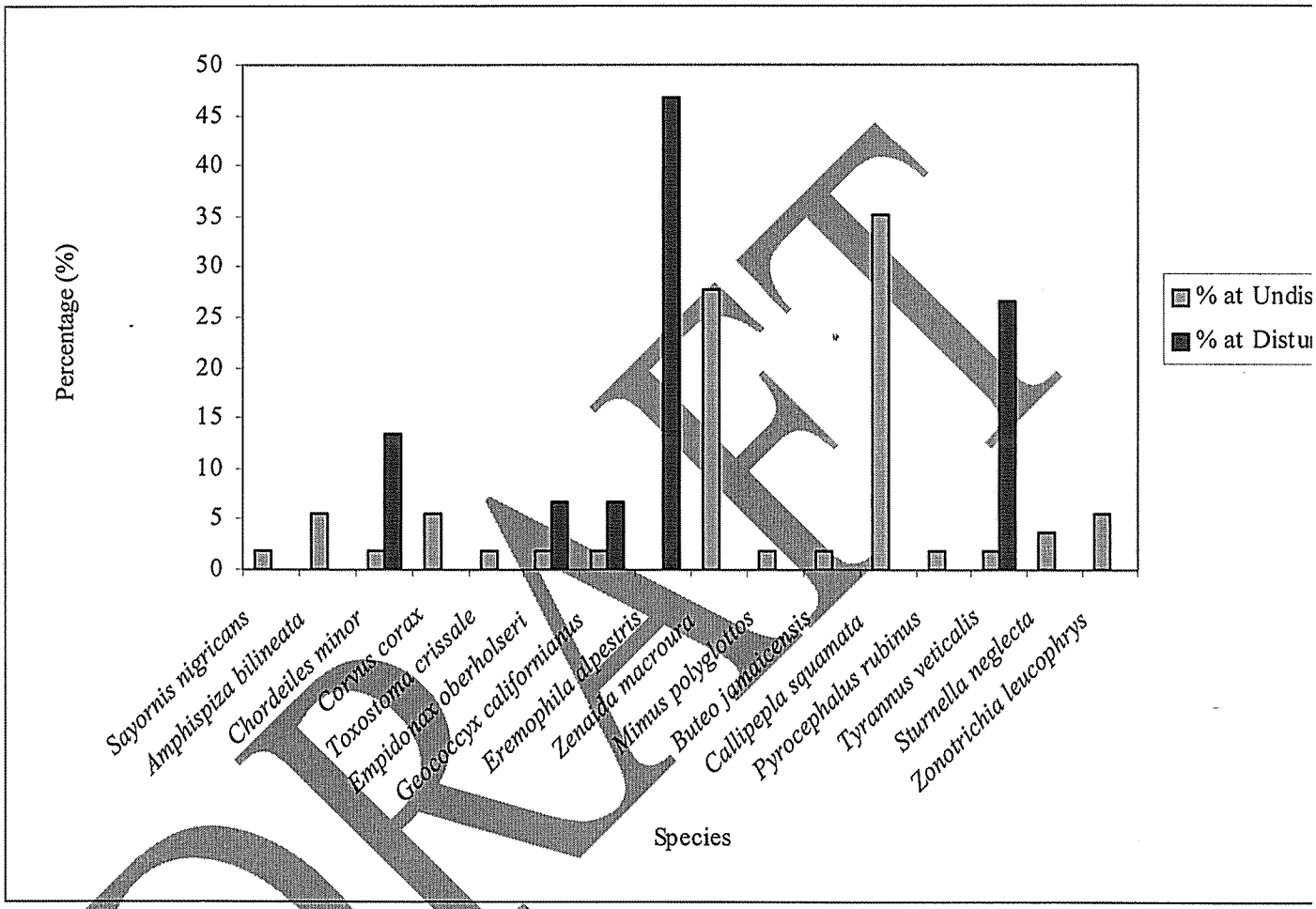

Figure 21. Graph of Species Composition Present at Undisturbed and Disturbed Sites For the Entire Survey Season.

Appendix A. Data Set for Undisturbed Sites Including Survey Number, Date, Latitude, Longitude, Total Number of Birds, Number of Species, H2S Concentration for Each Survey.

Survey #	Date	Latitude (Decimal Degrees)	Longitude (Decimal Degrees)		Number of Species	H2S Concentration (ppm)
1	11/21/2002	32 47.198	104 12.175	11	4	0
2	11/21/2002	32 46.599	104 12.262	6	2	0
3	11/21/2002	32 43.800	104 12.681	2	1	0
4	11/21/2002	32 43.124	104 12.733	1	1	0
5	11/21/2002	32 42.378	104 12.773	0	0	0
6	11/21/2002	32 39.473	104 13.329	5	2	0
7	11/21/2002	32 38.219	104 13.478	3	1	1
8	11/21/2002	32 37.594	104 13.494	0	0	0
9	11/21/2002	32 34.875	104 13.536	7	3	1
10	11/21/2002	32 34.107	104 13.550	0	0	0
11	12/3/2002	32 41.506	103 53.533	11	3	0
12	12/3/2002	32 41.345	103 54.174	8	3	0
13	12/3/2002	32 41.333	103 55.009	4	2	0
14	12/3/2002	32 41.339	103 55.752	0	0	0
15	12/3/2002	32 39.819	103 59.512	8	3	0
16	12/3/2002	32 39.611	104 00.238	1	1	0
17	12/3/2002	32 38.270	104 01.261	0	0	0
18	12/3/2002	32 38.050	104 01.799	3	1	0
19	12/3/2002	32 39.368	104 05.306	15	3	0
20	12/3/2002	32 39.513	104 06.393	3	1	1
21	1/7/2003	32 46.822	103 46.008	1	1	0
22	1/7/2003	32 46.481	103 46.475	0	0	0
23	1/7/2003	32 46.121	103 46.829	5	2	0
24	1/7/2003	32 42.749	103 47.806	6	2	0
25	1/7/2003	32 42.269	103 47.806	3	1	0
26	1/7/2003	32 41.710	103 47.806	15	3	0
27	1/7/2003	32 41.098	103 47.806	1	1	0
28	1/7/2003	32 40.331	103 47.806	5	2	0
29	1/7/2003	32 39.456	103 46.008	12	3	0
30	1/7/2003	32 39.502	103 45.236	7	2	1
31	1/23/2003	32 49.670	103 31.765	11	4	0
32	1/23/2003	32 49.670	103 32.398	3	1	0
33	1/23/2003	32 49.670	103 33.112	15	3	0
34	1/23/2003	32 49.670	103 33.731	4	2	0
35	1/23/2003	32 48.244	103 37.717	3	1	0
36	1/23/2003	32 48.125	103 38.392	2	1	0
37	1/23/2003	32 48.267	103 38.944	8	2	0
38	1/23/2003	32 48.093	103 40.662	3	1	0
39	1/23/2003	32 48.127	103 41.266	2	1	0
40	1/23/2003	32 48.702	103 42.100	0	0	0
41	2/11/2003	32 46.944	104 01.178	0	0	0
42	2/11/2003	32 46.429	104 01.176	0	0	0
43	2/11/2003	32 45.360	104 01.063	0	0	0
44	2/11/2003	32 44.865	104 01.078	0	0	0
45	2/11/2003	32 49.834	103 58.738	0	0	0
46	2/11/2003	32 50.392	103 58.648	0	0	0
47	2/11/2003	32 51.599	103 58.646	1	1	0
48	2/11/2003	32 52.347	103 57.871	1	1	0
49	3/4/2003	32 53.782	104 02.201	1	1	0
50	3/4/2003	32 53.217	104 02.200	0	0	0
51	3/4/2003	32 50.376	104 02.222	1	1	1
52	3/4/2003	32 50.835	104 04.304	0	0	1
53	4/3/2003	32 51.366	104 02.243	1	1	1
54	4/3/2003	32 51.369	104 02.937	0	0	0
55	4/3/2003	32 52.337	104 01.274	1	1	0
56	4/3/2003	32 52.345	104 59.666	0	0	0
57	4/3/2003	32 52.842	104 58.861	4	1	0
58	4/3/2003	32 54.841	103 57.774	0	0	0
59	4/3/2003	32 54.839	103 55.964	0	0	0
60	4/3/2003	32 54.712	103 55.375	2	1	0
61	4/3/2003	32 53.972	103 55.444	1	1	0
62	4/9/2003	32 53.374	103 55.572	0	0	0
63	4/9/2003	32 50.316	103 55.856	3	2	0
64	4/9/2003	32 48.011	103 56.371	1	1	0
65	4/9/2003	32 51.548	103 55.603	0	0	0
66	4/9/2003	32 51.256	103 54.515	6	1	0
67	4/9/2003	32 50.811	103 54.496	1	1	0
68	4/16/2003	32 48.112	104 01.179	3	2	0
69	4/16/2003	32 46.812	104 01.177	4	2	0
70	4/16/2003	32 46.242	104 01.180	1	1	0
71	4/16/2003	32 45.106	104 01.034	2	2	0
72	4/16/2003	32 45.340	104 00.460	1	1	0
73	4/16/2003	32 43.319	103 59.878	1	1	0
74	4/16/2003	32 45.208	103 59.290	0	0	0
75	4/16/2003	32 45.591	103 59.069	0	0	0
76	4/16/2003	32 46.112	103 59.064	1	1	0
77	4/16/2003	32 46.612	103 59.056	2	2	0
78	4/16/2003	32 46.959	103 59.546	0	0	0
79	4/16/2003	32 46.977	104 00.116	3	1	0
80	4/16/2003	32 46.981	104 00.714	3	2	0
81	4/24/2003	33 02.319	103 59.128	2	1	0
82	4/24/2003	33 01.809	103 59.121	3	1	0
83	4/24/2003	33 01.252	103 55.133	0	0	0
84	4/24/2003	32 59.638	103 59.133	2	1	0
85	4/24/2003	32 58.021	103 59.127	2	1	0
86	4/24/2003	32 58.460	103 59.128	3	2	2
87	4/24/2003	32 57.922	103 59.127	0	0	1
88	4/24/2003	32 57.363	103 59.124	1	1	1
89	4/24/2003	32 57.253	103 56.922	2	1	1
90	4/24/2003	32 57.349	103 56.638	1	1	1
91	4/24/2003	32 57.846	103 56.045	2	1	1

Appendix A. Data Set for Disturbed Sites Including Survey Number, Date, Latitude, Longitude, Total Number of Birds, Number of Species, H2S Concentration for Each Survey.

Survey #	Date	Latitude (Decimal Degrees)	Longitude (Decimal Degrees)	Total # of Birds	Number of Species	H2S Concentration (ppm)
1	11/21/2002	32 45.897	104 12.439	2	1	1
2	11/21/2002	32 45.221	104 12.567	0	0	1
3	11/21/2002	32 44.503	104 12.627	0	0	1
4	11/21/2002	32 41.705	104 12.828	0	0	1
5	11/21/2002	32 40.936	104 12.855	3	2	1
6	11/21/2002	32 40.249	104 13.169	1	1	2
7	11/21/2002	32 38.818	104 13.419	1	1	2
8	11/21/2002	32 36.917	104 13.511	4	2	2
9	11/21/2002	32 36.301	104 13.555	0	0	1
10	11/21/2002	32 35.577	104 13.523	0	0	1
11	12/3/2002	32 41.632	103 56.499	0	0	1
12	12/3/2002	32 41.848	103 56.970	2	1	1
13	12/3/2002	32 41.215	103 57.395	1	1	2
14	12/3/2002	32 40.738	103 58.077	1	1	2
15	12/3/2002	32 40.279	103 58.967	1	1	2
16	12/3/2002	32 39.458	104 01.062	0	0	2
17	12/3/2002	32 38.830	104 01.297	0	0	1
18	12/3/2002	32 38.400	104 02.573	2	2	2
19	12/3/2002	32 38.712	104 03.346	0	0	1
20	12/3/2002	32 39.053	104 04.194	0	0	2
21	1/7/2003	32 45.488	103 46.838	0	0	3
22	1/7/2003	32 45.015	103 47.168	2	1	1
23	1/7/2003	32 44.674	103 47.568	0	0	1
24	1/7/2003	32 44.130	103 47.742	2	1	1
25	1/7/2003	32 43.531	103 47.731	4	2	1
26	1/7/2003	32 39.719	103 47.798	0	0	1
27	1/7/2003	32 39.206	103 47.785	2	1	1
28	1/7/2003	32 38.691	103 47.785	3	3	2
29	1/7/2003	32 38.068	103 47.882	0	0	2
30	1/7/2003	32 39.417	103 46.657	0	0	2
31	1/23/2003	32 49.623	103 34.519	0	0	2
32	1/23/2003	32 49.371	103 35.113	2	1	1
33	1/23/2003	32 49.168	103 35.604	0	0	1
34	1/23/2003	32 48.932	103 36.160	0	0	1
35	1/23/2003	32 48.685	103 36.718	1	1	1
36	1/23/2003	32 48.477	103 37.190	2	1	3
37	1/23/2003	32 48.371	103 39.515	0	0	3
38	1/23/2003	32 48.269	103 40.061	0	0	3
39	1/23/2003	32 48.475	103 41.626	0	0	3
40	1/23/2003	32 49.093	103 42.697	0	0	1
41	2/11/2003	32 48.608	104 01.177	0	0	2
42	2/11/2003	32 48.040	104 01.176	1	1	1
43	2/11/2003	32 47.573	104 01.275	0	0	1
44	2/11/2003	32 45.843	104 01.181	0	0	2
45	2/11/2003	32 51.035	103 58.713	0	0	1
46	2/11/2003	32 52.047	103 58.331	0	0	2
47	3/4/2003	32 52.523	104 02.62	0	0	1
48	3/4/2003	32 50.91	104 02.241	0	0	2
49	3/4/2003	32 49.976	104 02.244	0	0	1
50	3/4/2003	32 49.413	104 02.222	0	0	1
51	4/3/2003	32 52.347	104 02.063	1	1	1
52	4/3/2003	32 52.348	104 00.571	0	0	1
53	4/3/2003	32 52.352	103 58.998	0	0	1
54	4/3/2003	32 52.419	103 58.162	0	0	1
55	4/3/2003	32 52.352	103 57.449	0	0	1
56	4/3/2003	32 52.360	103 56.776	0	0	2
57	4/3/2003	32 54.890	103 56.705	0	0	2
58	4/9/2003	32 52.904	103 55.585	0	0	2
59	4/9/2003	32 52.343	103 55.665	0	0	1
60	4/9/2003	32 51.924	103 55.657	0	0	1
61	4/9/2003	32 51.271	103 55.651	0	0	1
62	4/9/2003	32 50.826	103 55.649	0	0	2
63	4/9/2003	32 49.852	103 56.037	0	0	1
64	4/9/2003	32 49.280	103 56.179	0	0	2
65	4/9/2003	32 48.809	103 56.236	0	0	1
66	4/9/2003	32 48.229	103 56.169	0	0	2
67	4/9/2003	32 49.727	103 54.487	0	0	1
68	4/9/2003	32 50.327	103 54.884	1	1	2
69	4/9/2003	32 50.290	103 55.259	0	0	1
70	4/9/2003	32 52.348	103 55.264	0	0	2
71	4/9/2003	32 52.039	103 54.801	0	0	1
72	4/16/2003	32 47.506	104 01.245	0	0	1
73	4/16/2003	32 45.703	104 01.181	0	0	1
74	4/16/2003	32 44.799	104 01.066	0	0	1
75	4/16/2003	32 47.487	104 00.742	0	0	1
76	4/24/2003	33 00.182	103 59.015	0	0	0
77	4/24/2003	32 56.831	103 58.885	0	0	1
78	4/24/2003	32 57.691	103 58.885	0	0	1
79	4/24/2003	32 57.365	103 57.992	0	0	0
80	4/24/2003	32 57.354	103 57.481	0	0	0
81	4/24/2003	32 56.944	103 54.179	2	1	1
82	4/24/2003	32 56.726	103 53.889	1	1	1
83	4/24/2003	32 57.078	103 52.745	1	1	1
84	6/28/2003	32 45.112	103 53.141	0	0	3
85	6/28/2003	32 45.757	103 53.253	0	0	3
86	6/28/2003	32 45.160	103 52.621	3	1	3
87	6/28/2003	32 45.172	103 53.109	1	1	2
88	6/28/2003	32 44.570	103 53.167	0	0	4
89	6/28/2003	32 44.119	103 53.319	0	0	4
90	6/28/2003	32 43.214	103 53.105	2	1	4
91	6/28/2003	32 46.034	103 46.613	1	1	3

Appendix A. Data Set for Undisturbed Sites Including Survey Number, Date, Latitude, Longitude, Total Number of Birds, Number of Species, H2S Concentration for Each Survey.

Survey #	Date	Latitude (Decimal Degrees)	Longitude (Decimal Degrees)		Number of Species	H2S Concentration (ppm)
92	4/24/2003	32 57.178	103 55.504	1	1	0
93	4/24/2003	32 57.174	103 54.812	1	1	0
94	4/24/2003	32 56.916	103 53.236	1	1	0
95	6/28/2003	32 45.387	103 52.995	3	1	0
96	6/28/2003	32 45.245	103 52.859	4	2	0
97	6/28/2003	32 44.986	103 52.313	1	1	0
98	6/28/2003	32 44.750	103 51.966	1	1	1
99	6/28/2003	32 44.495	103 51.638	2	1	0
100	6/28/2003	32 44.220	103 51.351	2	1	0
101	6/28/2003	32 45.457	103 45.387	2	1	0
102	6/28/2003	32 44.816	103 45.387	3	1	0
103	6/28/2003	32 44.392	103 44.958	0	0	0
104	6/28/2003	32 44.095	103 45.375	1	1	0
105	7/17/2003	32 48.549	103 45.524	2	1	1
106	7/17/2003	32 50.330	103 55.485	11	1	1
107	7/17/2003	32 51.707	103 55.485	0	0	1
108	7/17/2003	32 52.097	103 55.815	0	0	1
109	8/6/2003	32 46.184	103 36.409	4	1	0
110	8/6/2003	32 46.556	103 36.245	2	1	0
111	8/6/2003	32 47.667	103 35.758	5	1	0
112	8/6/2003	32 48.037	103 35.200	0	0	0
113	8/6/2003	32 48.407	103 34.755	3	1	0
114	8/6/2003	32 48.781	103 34.433	1	1	0
115	8/6/2003	32 49.473	103 33.974	0	0	0
116	8/6/2003	32 43.828	103 36.236	2	1	0
117	8/6/2003	32 42.769	103 35.650	2	2	1
118	8/6/2003	32 42.430	103 35.308	1	1	0
119	8/6/2003	32 42.182	103 36.321	2	1	1
120	8/6/2003	32 41.805	103 36.053	0	0	0

Appendix A. Data Set for Disturbed Sites Including Survey Number, Date, Latitude, Longitude, Total Number of Birds, Number of Species, H2S Concentration for Each Survey.

Survey #	Date	Latitude (Decimal Degrees)	Longitude (Decimal Degrees)	Total # of Birds	Number of Species	H2S Concentration (ppm)
92	6/28/2003	32 46.253	103 46.162	0	0	2
93	6/28/2003	32 46.246	103 45.396	0	0	2
94	6/28/2003	32 46.252	103 44.863	0	0	1
95	6/28/2003	32 45.884	103 45.651	0	0	1
96	6/28/2003	32 45.027	103 45.927	0	0	4
97	6/28/2003	32 43.828	103 45.472	0	0	7
98	6/28/2003	32 43.646	103 46.089	2	1	3
99	7/17/2003	32 48.549	103 45.748	2	2	0
100	7/17/2003	32 48.552	103 45.257	0	0	1
101	7/17/2003	32 48.009	103 45.136	0	0	1
102	7/17/2003	32 48.968	103 52.215	0	0	1
103	7/17/2003	32 49.560	103 52.575	0	0	1
104	7/17/2003	32 49.757	103 52.799	1	1	1
105	7/17/2003	32 49.304	103 52.686	1	1	1
106	7/17/2003	32 48.958	103 54.395	0	0	0
107	7/17/2003	32 50.333	103 54.861	0	0	0
108	7/17/2003	32 50.836	103 55.644	0	0	0
109	7/17/2003	32 51.592	103 55.274	0	0	0
110	8/6/2003	32 45.626	103 36.409	1	1	2
111	8/6/2003	32 44.697	103 36.544	0	0	1
112	8/6/2003	32 44.090	103 36.599	0	0	3
113	8/6/2003	32 43.622	103 35.854	0	0	3
114	8/6/2003	32 43.001	103 35.843	1	1	1
115	8/6/2003	32 43.010	103 36.122	0	0	4
116	8/6/2003	32 42.772	103 36.597	0	0	1

Appendix B. Data Set for Undisturbed Sites Including Survey Number, Date, Latitude, Longitude, and Species Composition for Each Survey.

Survey #	Date	Latitude (Decimal Degrees)	Longitude (Decimal Degrees)	American Kestrel	Bell's Vireo	Bewicks Wren	Black Phoebe	Black Throated Sparrow	Brewer's Black Bird	Brown Headed Cowbird	Cactus Wren	Common Grackle	Common Nighthawk	Common Raven	Crissal Thrasher	Curved Bill Thrasher	Dusky Flycatcher	European Starling
1	11/21/2002	32 47.198	104 12.175															
2	11/21/2002	32 46.599	104 12.262	1														
3	11/21/2002	32 43.800	104 12.681								2							
4	11/21/2002	32 43.124	104 12.733				1											
5	11/21/2002	32 42.378	104 12.773															
6	11/21/2002	32 39.473	104 13.339					1										
7	11/21/2002	32 38.219	104 13.478						3									
8	11/21/2002	32 37.594	104 13.494															
9	11/21/2002	32 34.875	104 13.536					3										
10	11/21/2002	32 34.107	104 13.550															
11	12/3/2002	32 41.506	103 53.533					5										
12	12/3/2002	32 41.345	103 54.174														1	
13	12/3/2002	32 41.333	103 55.009															
14	12/3/2002	32 41.339	103 55.752															
15	12/3/2002	32 39.819	103 59.512						2			5						
16	12/3/2002	32 39.611	104 00.238															
17	12/3/2002	32 38.270	104 01.261															
18	12/3/2002	32 38.050	104 01.799															
19	12/3/2002	32 39.368	104 05.306															
20	12/3/2002	32 39.513	104 06.393															
21	1/7/2003	32 46.822	103 46.008			3												
22	1/7/2003	32 46.481	103 46.475											4				
23	1/7/2003	32 46.121	103 46.829															
24	1/7/2003	32 42.749	103 47.806															
25	1/7/2003	32 42.269	103 47.806													3		
26	1/7/2003	32 41.710	103 47.806															
27	1/7/2003	32 41.098	103 47.806	1														
28	1/7/2003	32 40.331	103 47.806		1													
29	1/7/2003	32 39.456	103 46.008					5										
30	1/7/2003	32 39.502	103 45.236												4			
31	1/23/2003	32 49.670	103 31.765	1														
32	1/23/2003	32 49.670	103 32.398															
33	1/23/2003	32 49.670	103 33.112						4	2								9
34	1/23/2003	32 49.670	103 33.731															
35	1/23/2003	32 48.244	103 37.717															
36	1/23/2003	32 48.125	103 38.392															
37	1/23/2003	32 48.267	103 38.944															
38	1/23/2003	32 48.093	103 40.662															
39	1/23/2003	32 48.127	103 41.266															
40	1/23/2003	32 48.702	103 42.100			1												
41	2/11/2003	32 46.944	104 01.178															
42	2/11/2003	32 46.429	104 01.176															
43	2/11/2003	32 45.360	104 01.063															
44	2/11/2003	32 44.865	104 01.078															
45	2/11/2003	32 49.834	103 58.738															
46	2/11/2003	32 50.392	103 58.648															
47	2/11/2003	32 51.599	103 58.646															
48	2/11/2003	32 52.347	103 57.871															
49	3/4/2003	32 53.782	104 02.201															
50	3/4/2003	32 53.217	104 02.200															
51	3/4/2003	32 50.376	104 02.222															
52	3/4/2003	32 50.835	104 04.304															
53	4/3/2003	32 51.366	104 02.243								1		4					
54	4/3/2003	32 51.369	104 02.937															
55	4/3/2003	32 52.337	104 01.274															
56	4/3/2003	32 52.345	104 59.666															
57	4/3/2003	32 52.842	104 58.861															
58	4/3/2003	32 54.841	103 57.774															
59	4/3/2003	32 54.839	103 55.964															
60	4/3/2003	32 54.712	103 55.375							2								
61	4/3/2003	32 53.972	103 55.444													1		
62	4/9/2003	32 53.374	103 55.572															
63	4/9/2003	32 50.316	103 55.856															
64	4/9/2003	32 48.011	103 56.371															
65	4/9/2003	32 51.548	103 55.603															
66	4/9/2003	32 51.256	103 54.515															
67	4/9/2003	32 50.811	103 54.496															
68	4/16/2003	32 48.112	104 01.179						1									
69	4/16/2003	32 46.812	104 01.177														1	
70	4/16/2003	32 46.242	104 01.180															
71	4/16/2003	32 45.106	104 01.034															
72	4/16/2003	32 45.340	104 00.460															
73	4/16/2003	32 43.319	103 59.878															
74	4/16/2003	32 45.208	103 59.290															
75	4/16/2003	32 45.591	103 59.069															
76	4/16/2003	32 46.112	103 59.064															
77	4/16/2003	32 46.612	103 59.056													1		
78	4/16/2003	32 46.959	103 59.546															

Appendix B. Data Set for Undisturbed Sites Including Survey Number, Date, Latitude, Longitude, and Species Composition for Each Survey.

Survey #	Date	Latitude (Decimal Degrees)	Longitude (Decimal Degrees)	American Kestrel	Bell's Vireo	Bewicks Wren	Black Phoebe	Black Throated Sparrow	Brewer's Black Bird	Brown Headed Cowbird	Cactus Wren	Common Grackle	Common Nighthawk	Common Raven	Crissal Thrasher	Curved Bill Thrasher	Dusky Flycatcher	European Starling
79	4/16/2003	32 46.977	104 00.116															
80	4/16/2003	32 46.981	104 00.714															
81	4/24/2003	33 02.319	103 59.128														2	
82	4/24/2003	33 01.809	103 59.121															
83	4/24/2003	33 01.252	103 55.133															
84	4/24/2003	32 59.638	103 59.133															
85	4/24/2003	32 58.021	103 59.127					2										
86	4/24/2003	32 58.460	103 59.128											1			2	
87	4/24/2003	32 57.922	103 59.127															
88	4/24/2003	32 57.363	103 59.124															
89	4/24/2003	32 57.253	103 56.922															
90	4/24/2003	32 57.349	103 56.638													1		
91	4/24/2003	32 57.846	103 56.045															
92	4/24/2003	32 57.178	103 55.504															
93	4/24/2003	32 57.174	103 54.812															
94	4/24/2003	32 56.916	103 53.236															
95	6/28/2003	32 45.387	103 52.995															
96	6/28/2003	32 45.245	103 52.859				1											
97	6/28/2003	32 44.986	103 52.313										1					
98	6/28/2003	32 44.750	103 51.966															
99	6/28/2003	32 44.495	103 51.638															
100	6/28/2003	32 44.220	103 51.351															
101	6/28/2003	32 45.457	103 45.387															
102	6/28/2003	32 44.816	103 45.387															
103	6/28/2003	32 44.392	103 44.958															
104	6/28/2003	32 44.095	103 45.375															
105	7/17/2003	32 48.549	103 45.524															
106	7/17/2003	32 50.330	103 55.485														1	
107	7/17/2003	32 51.707	103 55.485															
108	7/17/2003	32 52.097	103 55.815															
109	8/6/2003	32 46.184	103 36.409											2				
110	8/6/2003	32 46.556	103 36.245															
111	8/6/2003	32 47.667	103 35.758															
112	8/6/2003	32 48.037	103 35.200															
113	8/6/2003	32 48.407	103 34.755					3										
114	8/6/2003	32 48.781	103 34.433											1				
115	8/6/2003	32 49.473	103 33.974															
116	8/6/2003	32 43.828	103 36.236															
117	8/6/2003	32 42.769	103 35.650												1			
118	8/6/2003	32 42.430	103 35.308															
119	8/6/2003	32 42.182	103 36.321															
120	8/6/2003	32 41.805	103 36.053															

Appendix B. Data Set for Undisturbed Sites Including Survey Number, Date, Latitude, Longitude, and Species Composition for Each Survey.

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Survey #	Date	Latitude (Decimal Degrees)	Longitude (Decimal Degrees)	Gray Vireo	Greater Roadrunner	Horned Lark	House Sparrow	Lucy's Warbler	Mourning Dove	Northern Harrier	Northern Mocking Bird	Pyrrhuloxia	Red Tailed Hawk	Says Phoebe	Scaled Quail	Scissor Tailed Flycatcher	Virginia's Warbler	Varied Bunting
1	11/21/2002	32 47.195	104 12.175		1				6				1		3			
2	11/21/2002	32 46.599	104 12.262						5									
3	11/21/2002	32 43.800	104 12.681															
4	11/21/2002	32 43.124	104 12.733															
5	11/21/2002	32 42.378	104 12.773															
6	11/21/2002	32 39.473	104 13.329															
7	11/21/2002	32 38.219	104 13.478															
8	11/21/2002	32 37.594	104 13.494															
9	11/21/2002	32 34.875	104 13.536								1							
10	11/21/2002	32 34.107	104 13.550															
11	12/3/2002	32 41.506	103 53.533								2							
12	12/3/2002	32 41.345	103 54.174						6	1								
13	12/3/2002	32 41.333	103 55.009															
14	12/3/2002	32 41.339	103 55.752															
15	12/3/2002	32 39.819	103 59.512				1											
16	12/3/2002	32 39.611	104 00.238									1						
17	12/3/2002	32 38.270	104 01.261															
18	12/3/2002	32 38.050	104 01.799															
19	12/3/2002	32 39.368	104 05.306										1					
20	12/3/2002	32 39.513	104 06.393						3						1			
21	1/7/2003	32 46.822	103 46.008											2				
22	1/7/2003	32 46.481	103 46.475															
23	1/7/2003	32 46.121	103 46.829															
24	1/7/2003	32 42.749	103 47.806															
25	1/7/2003	32 42.269	103 47.806															
26	1/7/2003	32 41.710	103 47.806						13		1							
27	1/7/2003	32 41.098	103 47.806															
28	1/7/2003	32 40.331	103 47.806												4			
29	1/7/2003	32 39.456	103 46.008				5										2	
30	1/7/2003	32 39.502	103 45.236										3					
31	1/23/2003	32 49.670	103 31.765					1	7									2
32	1/23/2003	32 49.670	103 32.398						3									
33	1/23/2003	32 49.670	103 33.112															
34	1/23/2003	32 49.670	103 33.731	7														
35	1/23/2003	32 48.244	103 37.717		1													
36	1/23/2003	32 48.125	103 38.392										2					
37	1/23/2003	32 48.267	103 38.944							1					7			
38	1/23/2003	32 48.093	103 40.662															
39	1/23/2003	32 48.127	103 41.266															
40	1/23/2003	32 48.702	103 42.100															
41	2/11/2003	32 46.944	104 01.178															
42	2/11/2003	32 46.429	104 01.176															
43	2/11/2003	32 45.360	104 01.063															
44	2/11/2003	32 44.865	104 01.078															
45	2/11/2003	32 49.834	103 58.738															
46	2/11/2003	32 50.392	103 58.648															
47	2/11/2003	32 51.599	103 58.646						1									
48	2/11/2003	32 52.347	103 57.871												1			
49	3/4/2003	32 53.782	104 02.201															
50	3/4/2003	32 53.217	104 02.200															
51	3/4/2003	32 50.376	104 02.222												1			
52	3/4/2003	32 50.835	104 04.304															
53	4/3/2003	32 51.366	104 02.243															
54	4/3/2003	32 51.369	104 02.937															
55	4/3/2003	32 52.337	104 01.274															
56	4/3/2003	32 52.345	104 59.666															
57	4/3/2003	32 52.842	104 58.861												4			
58	4/3/2003	32 54.841	103 57.774															
59	4/3/2003	32 54.839	103 55.964															
60	4/3/2003	32 54.712	103 55.375															
61	4/3/2003	32 53.972	103 55.444															
62	4/9/2003	32 53.374	103 55.572															
63	4/9/2003	32 50.316	103 55.856															
64	4/9/2003	32 48.011	103 56.371		1													
65	4/9/2003	32 51.548	103 55.603															
66	4/9/2003	32 51.256	103 54.515												6			
67	4/9/2003	32 50.811	103 54.496						1									
68	4/16/2003	32 48.112	104 01.179												2			
69	4/16/2003	32 46.812	104 01.177															
70	4/16/2003	32 46.242	104 01.180															
71	4/16/2003	32 45.106	104 01.034						1									
72	4/16/2003	32 45.340	104 00.460								1							
73	4/16/2003	32 43.319	103 59.878												1			
74	4/16/2003	32 45.208	103 59.290															
75	4/16/2003	32 45.591	103 59.069															
76	4/16/2003	32 46.112	103 59.064															
77	4/16/2003	32 46.612	103 59.056															
78	4/16/2003	32 46.959	103 59.546															

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Appendix B. Data Set for Undisturbed Sites Including Survey Number, Date, Latitude, Longitude, and Species Composition for Each Survey.

Survey #	Date	Latitude (Decimal Degrees)	Longitude (Decimal Degrees)	Gray Vireo	Greater Roadrunner	Horned Lark	House Sparrow	Lucy's Warbler	Mourning Dove	Northern Harrier	Northern Mocking Bird	Pyrrhuloxia	Red Tailed Hawk	Says Phoebe	Scaled Quail	Scissor Tailed Flycatcher	Virginia's Warbler	Varied Bunting
79	4/16/2003	32 46.977	104 00.116															
80	4/16/2003	32 46.981	104 00.714						2									
81	4/24/2003	33 02.319	103 59.128															
82	4/24/2003	33 01.809	103 59.121													3		
83	4/24/2003	33 01.252	103 55.133															
84	4/24/2003	32 59.638	103 59.133						2									
85	4/24/2003	32 58.021	103 59.127															
86	4/24/2003	32 58.460	103 59.128															
87	4/24/2003	32 57.922	103 59.127															
88	4/24/2003	32 57.363	103 59.124								2							
89	4/24/2003	32 57.253	103 56.922								1							
90	4/24/2003	32 57.349	103 56.638															
91	4/24/2003	32 57.846	103 56.045								2							
92	4/24/2003	32 57.178	103 55.504															
93	4/24/2003	32 57.174	103 54.812															
94	4/24/2003	32 56.916	103 53.236		1													
95	6/28/2003	32 45.387	103 52.995						3									
96	6/28/2003	32 45.245	103 52.859						3									
97	6/28/2003	32 44.986	103 52.313															
98	6/28/2003	32 44.750	103 51.966										1					
99	6/28/2003	32 44.495	103 51.638						2									
100	6/28/2003	32 44.220	103 51.351						1									
101	6/28/2003	32 45.457	103 45.387												2			
102	6/28/2003	32 44.816	103 45.387															
103	6/28/2003	32 44.392	103 44.958															
104	6/28/2003	32 44.095	103 45.375		1													
105	7/17/2003	32 48.549	103 45.524						2									
106	7/17/2003	32 50.330	103 55.485												11			
107	7/17/2003	32 51.707	103 55.485															
108	7/17/2003	32 52.097	103 55.815															
109	8/6/2003	32 46.184	103 36.409															
110	8/6/2003	32 46.556	103 36.245								1							
111	8/6/2003	32 47.667	103 35.758												5			
112	8/6/2003	32 48.037	103 35.200															
113	8/6/2003	32 48.407	103 34.755															
114	8/6/2003	32 48.781	103 34.433															
115	8/6/2003	32 49.473	103 33.974															
116	8/6/2003	32 43.828	103 36.236						2									
117	8/6/2003	32 42.769	103 35.650						1									
118	8/6/2003	32 42.430	103 35.308						1									
119	8/6/2003	32 42.182	103 36.321															
120	8/6/2003	32 41.805	103 36.053															

Appendix B. Data Set for Undisturbed Sites Including Survey Number, Date, Latitude, Longitude, and Species Composition for Each Survey.

Survey #	Date	Latitude (Decimal Degrees)	Longitude (Decimal Degrees)	Vermillion Flycatcher	Western Kingbird	Western Meadow Lark	Western Scrub Jay	Western Wood Peewee	White Crowned Sparrow	White Winged Doved	Yellow Billed Cuckoo	Yellow Headed Black Bird	Yellow Rumped Warbler
1	11/21/2002	32 47.198	104 12.175										
2	11/21/2002	32 46.599	104 12.262										
3	11/21/2002	32 43.800	104 12.681										
4	11/21/2002	32 43.124	104 12.733										
5	11/21/2002	32 42.378	104 12.773										
6	11/21/2002	32 39.473	104 13.329								1		
7	11/21/2002	32 38.219	104 13.478										
8	11/21/2002	32 37.594	104 13.494										
9	11/21/2002	32 34.875	104 13.536						3				
10	11/21/2002	32 34.107	104 13.550										
11	12/3/2002	32 41.506	103 53.533						4				
12	12/3/2002	32 41.345	103 54.174										
13	12/3/2002	32 41.333	103 55.009									2	1
14	12/3/2002	32 41.339	103 55.752										
15	12/3/2002	32 39.819	103 59.512										
16	12/3/2002	32 39.611	104 00.238										
17	12/3/2002	32 38.270	104 01.261										
18	12/3/2002	32 38.050	104 01.799						3				
19	12/3/2002	32 39.368	104 05.306			2				12			
20	12/3/2002	32 39.513	104 06.393										
21	1/7/2003	32 46.822	103 46.008										
22	1/7/2003	32 46.481	103 46.475				2						
23	1/7/2003	32 46.121	103 46.829										
24	1/7/2003	32 42.749	103 47.806										
25	1/7/2003	32 42.269	103 47.806										
26	1/7/2003	32 41.710	103 47.806						1				
27	1/7/2003	32 41.098	103 47.806										
28	1/7/2003	32 40.331	103 47.806										
29	1/7/2003	32 39.456	103 46.008										
30	1/7/2003	32 39.502	103 45.236										
31	1/23/2003	32 49.670	103 31.765										
32	1/23/2003	32 49.670	103 32.398										
33	1/23/2003	32 49.670	103 33.112										
34	1/23/2003	32 49.670	103 33.731						3				
35	1/23/2003	32 48.244	103 37.717										
36	1/23/2003	32 48.125	103 38.392										
37	1/23/2003	32 48.267	103 38.944										
38	1/23/2003	32 48.093	103 40.662						3				
39	1/23/2003	32 48.127	103 41.266									2	
40	1/23/2003	32 48.702	103 42.100										
41	2/11/2003	32 46.944	104 01.178										
42	2/11/2003	32 46.429	104 01.176										
43	2/11/2003	32 45.360	104 01.063										
44	2/11/2003	32 44.865	104 01.078										
45	2/11/2003	32 49.834	103 58.738										
46	2/11/2003	32 50.392	103 58.648										
47	2/11/2003	32 51.599	103 58.646										
48	2/11/2003	32 52.347	103 57.871										
49	3/4/2003	32 53.782	104 02.201						1				
50	3/4/2003	32 53.217	104 02.200										
51	3/4/2003	32 50.376	104 02.222										
52	3/4/2003	32 50.835	104 04.304										
53	4/3/2003	32 51.366	104 02.243										4
54	4/3/2003	32 51.369	104 02.937										
55	4/3/2003	32 52.337	104 01.274	1									
56	4/3/2003	32 52.345	104 59.666										
57	4/3/2003	32 52.842	104 58.861										
58	4/3/2003	32 54.841	103 57.774										
59	4/3/2003	32 54.839	103 55.964										
60	4/3/2003	32 54.712	103 55.375										
61	4/3/2003	32 53.972	103 55.444										
62	4/9/2003	32 53.374	103 55.572										
63	4/9/2003	32 50.316	103 55.856				1		2				
64	4/9/2003	32 48.011	103 56.371										
65	4/9/2003	32 51.548	103 55.603										
66	4/9/2003	32 51.256	103 54.515										
67	4/9/2003	32 50.811	103 54.496										
68	4/16/2003	32 48.112	104 01.179										
69	4/16/2003	32 46.812	104 01.177			3							
70	4/16/2003	32 46.242	104 01.180						1				
71	4/16/2003	32 45.106	104 01.034			1							
72	4/16/2003	32 45.340	104 00.460										
73	4/16/2003	32 43.319	103 59.878										
74	4/16/2003	32 45.208	103 59.290										
75	4/16/2003	32 45.591	103 59.069										
76	4/16/2003	32 46.112	103 59.064			1							
77	4/16/2003	32 46.612	103 59.056					1					
78	4/16/2003	32 46.959	103 59.546										

Appendix B. Data Set for Undisturbed Sites Including Survey Number, Date, Latitude, Longitude, and Species Composition for Each Survey.

Survey #	Date	Latitude (Decimal Degrees)	Longitude (Decimal Degrees)	Vermillion Flycatcher	Western Kingbird	Western Meadow Lark	Western Scrub Jay	Western Wood Peewee	White Crowned Sparrow	White Winged Doved	Yellow Billed Cuckoo	Yellow Headed Black Bird	Yellow Rumped Warbler
79	4/16/2003	32 46.977	104 00.116						3				
80	4/16/2003	32 46.981	104 00.714				1						
81	4/24/2003	33 02.319	103 59.128										
82	4/24/2003	33 01.809	103 59.121										
83	4/24/2003	33 01.252	103 55.133										
84	4/24/2003	32 59.638	103 59.133										
85	4/24/2003	32 58.021	103 59.127										
86	4/24/2003	32 58.460	103 59.128										
87	4/24/2003	32 57.922	103 59.127										
88	4/24/2003	32 57.363	103 59.124										
89	4/24/2003	32 57.253	103 56.922										
90	4/24/2003	32 57.349	103 56.638										
91	4/24/2003	32 57.846	103 56.045										
92	4/24/2003	32 57.178	103 55.504				1						
93	4/24/2003	32 57.174	103 54.812			1							
94	4/24/2003	32 56.916	103 53.236										
95	6/28/2003	32 45.387	103 52.995										
96	6/28/2003	32 45.245	103 52.859										
97	6/28/2003	32 44.986	103 52.313										
98	6/28/2003	32 44.750	103 51.966										
99	6/28/2003	32 44.495	103 51.638										
100	6/28/2003	32 44.220	103 51.351										
101	6/28/2003	32 45.457	103 45.387										
102	6/28/2003	32 44.816	103 45.387						3				
103	6/28/2003	32 44.392	103 44.958										
104	6/28/2003	32 44.095	103 45.375										
105	7/17/2003	32 48.549	103 45.524		1								
106	7/17/2003	32 50.330	103 55.485										
107	7/17/2003	32 51.707	103 55.485										
108	7/17/2003	32 52.097	103 55.815										
109	8/6/2003	32 46.184	103 36.409										
110	8/6/2003	32 46.556	103 36.245										
111	8/6/2003	32 47.667	103 35.758										
112	8/6/2003	32 48.037	103 35.200	1									
113	8/6/2003	32 48.407	103 34.755										
114	8/6/2003	32 48.781	103 34.433										
115	8/6/2003	32 49.473	103 33.974										
116	8/6/2003	32 43.828	103 36.236										
117	8/6/2003	32 42.769	103 35.650										
118	8/6/2003	32 42.430	103 35.308										
119	8/6/2003	32 42.182	103 36.321			2							
120	8/6/2003	32 41.805	103 36.053										

Appendix C. Data Set for Disturbed Sites Including Survey Number, Date, Latitude, Longitude, and Species Composition for Each Survey.

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Survey #	Date	Latitude (Decimal Degrees)	Longitude (Decimal Degrees)	American Kestrel	Bell's Vireo	Bewicks Wren	Black Phoebe	Black Throated Sparrow	Brewer's Black Bird	Brown Headed Cowbird	Cactus Wren	Common Grackle	Common Nighthawk	Common Raven	Crissal Thrasher	Curved Bill Thrasher	Dusky Flycatcher	European Starling	Gray Vireo	Greater Roadrunner	Horned Lark	House Sparrow	Lucy's Warbler	Mourning Dove	Northern Harrier
1	11/21/2002	32 45.897	104 12.439																					2	
2	11/21/2002	32 45.221	104 12.567																						
3	11/21/2002	32 44.503	104 12.627																						
4	11/21/2002	32 41.705	104 12.828																						
5	11/21/2002	32 40.936	104 12.855											2											
6	11/21/2002	32 40.249	104 13.169																						
7	11/21/2002	32 38.818	104 13.419																			1			
8	11/21/2002	32 36.917	104 13.511						1			4													
9	11/21/2002	32 36.301	104 13.555																						
10	11/21/2002	32 35.577	104 13.523																						
11	12/3/2002	32 41.632	103 56.499																						
12	12/3/2002	32 41.848	103 56.970																					2	
13	12/3/2002	32 41.215	103 57.395																						
14	12/3/2002	32 40.738	103 58.077												1										
15	12/3/2002	32 40.279	103 58.967		1																				
16	12/3/2002	32 39.458	104 01.062																						
17	12/3/2002	32 38.830	104 01.297																						
18	12/3/2002	32 38.400	104 02.573																					2	
19	12/3/2002	32 38.712	104 03.346																						
20	12/3/2002	32 39.053	104 04.194																						
21	1/7/2003	32 45.488	103 46.838																						
22	1/7/2003	32 45.015	103 47.168																					3	
23	1/7/2003	32 44.674	103 47.568																						
24	1/7/2003	32 44.130	103 47.742																						
25	1/7/2003	32 43.531	103 47.731	2																				2	
26	1/7/2003	32 39.719	103 47.798																						
27	1/7/2003	32 39.206	103 47.785																						
28	1/7/2003	32 38.691	103 47.785					1														1			
29	1/7/2003	32 38.068	103 47.882																						
30	1/7/2003	32 39.417	103 46.657																						
31	1/23/2003	32 49.623	103 34.519																						
32	1/23/2003	32 49.371	103 35.113																						
33	1/23/2003	32 49.168	103 35.604																						
34	1/23/2003	32 48.932	103 36.160																						
35	1/23/2003	32 48.685	103 36.718																				1		
36	1/23/2003	32 48.477	103 37.190																						
37	1/23/2003	32 48.371	103 39.515																						
38	1/23/2003	32 48.269	103 40.061																						
39	1/23/2003	32 48.475	103 41.626																						
40	1/23/2003	32 49.093	103 42.697																						
41	2/11/2003	32 48.608	104 01.177																						
42	2/11/2003	32 48.040	104 01.176													1									
43	2/11/2003	32 47.573	104 01.275																						
44	2/11/2003	32 45.843	104 01.181																						
45	2/11/2003	32 51.035	103 58.713																						
46	2/11/2003	32 52.047	103 58.331																						
47	3/4/2003	32 52.523	104 02.62																						
48	3/4/2003	32 50.91	104 02.241																						
49	3/4/2003	32 49.976	104 02.244																						
50	3/4/2003	32 49.413	104 02.222																						
51	4/3/2003	32 52.347	104 02.063					1																	
52	4/3/2003	32 52.348	104 00.571																						
53	4/3/2003	32 52.352	103 58.998																						
54	4/3/2003	32 52.419	103 58.162																						
55	4/3/2003	32 52.352	103 57.449																						
56	4/3/2003	32 52.360	103 56.776																						
57	4/3/2003	32 54.890	103 56.705																						
58	4/9/2003	32 52.904	103 55.585																						
59	4/9/2003	32 52.343	103 55.665																						
60	4/9/2003	32 51.924	103 55.657																						
61	4/9/2003	32 51.271	103 55.651																						
62	4/9/2003	32 50.826	103 55.649																						
63	4/9/2003	32 49.852	103 56.037																						
64	4/9/2003	32 49.280	103 56.179																						
65	4/9/2003	32 48.809	103 56.236																						
66	4/9/2003	32 48.229	103 56.169																						
67	4/9/2003	32 49.727	103 54.487																						
68	4/9/2003	32 50.327	103 54.884																						
69	4/9/2003	32 50.290	103 55.259																						
70	4/9/2003	32 52.348	103 55.264																						
71	4/9/2003	32 52.039	103 54.801																						
72	4/16/2003	32 47.506	104 01.245																						
73	4/16/2003	32 45.703	104 01.181																						
74	4/16/2003	32 44.799	104 01.066																						
75	4/16/2003	32 47.487	104 00.742																						

Appendix C. Data Set for Disturbed Sites Including Survey Number, Date, Latitude, Longitude, and Species Composition for Each Survey.

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Survey #	Date	Latitude (Decimal Degrees)	Longitude (Decimal Degrees)	American Kestrel	Bell's Vireo	Bewicks Wren	Black Phoebe	Black Throated Sparrow	Brewer's Black Bird	Brown Headed Cowbird	Cactus Wren	Common Grackle	Common Nighthawk	Common Raven	Crissal Thrasher	Curved Bill Thrasher	Dusky Flycatcher	European Starling	Gray Vireo	Greater Roadrunner	Horned Lark	House Sparrow	Lucy's Warbler	Mourning Dove	Northern Harrier
76	4/24/2003	33 00.182	103 59.015																						
77	4/24/2003	32 56.831	103 58.885																						
78	4/24/2003	32 57.691	103 58.885																						
79	4/24/2003	32 57.365	103 57.992																						
80	4/24/2003	32 57.354	103 57.481																						
81	4/24/2003	32 56.944	103 54.179																					2	
82	4/24/2003	32 56.726	103 53.889																						
83	4/24/2003	32 57.078	103 52.745																					1	
84	6/28/2003	32 45.112	103 53.141																						
85	6/28/2003	32 45.757	103 53.253																						
86	6/28/2003	32 45.160	103 52.621																		3				
87	6/28/2003	32 45.172	103 53.109														1								
88	6/28/2003	32 44.570	103 53.167																						
89	6/28/2003	32 44.119	103 53.319																						
90	6/28/2003	32 43.214	103 53.105										2								1				
91	6/28/2003	32 46.034	103 46.613																						
92	6/28/2003	32 46.253	103 46.162																						
93	6/28/2003	32 46.246	103 45.396																						
94	6/28/2003	32 46.252	103 44.863																						
95	6/28/2003	32 45.884	103 45.651																						
96	6/28/2003	32 45.027	103 45.927																						
97	6/28/2003	32 43.828	103 45.472																						
98	6/28/2003	32 43.646	103 46.089																		2				
99	7/17/2003	32 48.549	103 45.748																						
100	7/17/2003	32 48.552	103 45.257																						
101	7/17/2003	32 48.009	103 45.136																						
102	7/17/2003	32 48.968	103 52.215																						
103	7/17/2003	32 49.560	103 52.575																						
104	7/17/2003	32 49.757	103 52.799																	1					
105	7/17/2003	32 49.304	103 52.686																						
106	7/17/2003	32 48.958	103 54.395																						
107	7/17/2003	32 50.333	103 54.861																						
108	7/17/2003	32 50.836	103 55.644																						
109	7/17/2003	32 51.592	103 55.274																						
110	8/6/2003	32 45.626	103 36.409																						
111	8/6/2003	32 44.697	103 36.544																						
112	8/6/2003	32 44.090	103 36.599																						
113	8/6/2003	32 43.622	103 35.854																						
114	8/6/2003	32 43.001	103 35.843																						
115	8/6/2003	32 43.010	103 36.122																						
116	8/6/2003	32 42.772	103 36.597																						

Appendix C. Data Set for Disturbed Sites Including Survey Nu
Date, Latitude, Longitude, and Species Composition for Each S

Survey #	Date	Latitude (Decimal Degrees)	Longitude (Decimal Degrees)	Northern Mocking Bird	Pyrrhuloxia	Red Tailed Hawk	Says Phoebe	Scaled Quail	Scissor Tailed Flycatcher	Virginia's Warbler	Varied Bunting	Vermillion Flycatcher	Western Kingbird	Western Meadow Lark	Western Scrub Jay	Western Wood Peewee	White Crowned Sparrow	White Winged Doved	Yellow Billed Cuckoo	Yellow Headed Black Bird	Yellow Rumped Warbler
1	11/21/2002	32 45.897	104 12.439																		
2	11/21/2002	32 45.221	104 12.567																		
3	11/21/2002	32 44.503	104 12.627																		
4	11/21/2002	32 41.705	104 12.828																		
5	11/21/2002	32 40.936	104 12.855	1																	
6	11/21/2002	32 40.249	104 13.169											1							
7	11/21/2002	32 38.818	104 13.419																		
8	11/21/2002	32 36.917	104 13.511																		
9	11/21/2002	32 36.301	104 13.555																		
10	11/21/2002	32 35.577	104 13.523																		
11	12/3/2002	32 41.632	103 56.499																		
12	12/3/2002	32 41.848	103 56.970																		
13	12/3/2002	32 41.215	103 57.395											1							
14	12/3/2002	32 40.738	103 58.077																		
15	12/3/2002	32 40.279	103 58.967																		
16	12/3/2002	32 39.458	104 01.062																		
17	12/3/2002	32 38.830	104 01.297																		
18	12/3/2002	32 38.400	104 02.573																		1
19	12/3/2002	32 38.712	104 03.346																		
20	12/3/2002	32 39.053	104 04.194																		
21	1/7/2003	32 45.488	103 46.838																		
22	1/7/2003	32 45.015	103 47.168																		
23	1/7/2003	32 44.674	103 47.568																		
24	1/7/2003	32 44.130	103 47.742								2										
25	1/7/2003	32 43.531	103 47.731																		
26	1/7/2003	32 39.719	103 47.798																		
27	1/7/2003	32 39.206	103 47.785					2													
28	1/7/2003	32 38.691	103 47.785														1				
29	1/7/2003	32 38.068	103 47.882																		
30	1/7/2003	32 39.417	103 46.657																		
31	1/23/2003	32 49.623	103 34.519																		
32	1/23/2003	32 49.371	103 35.113			2															
33	1/23/2003	32 49.168	103 35.604																		
34	1/23/2003	32 48.932	103 36.160																		
35	1/23/2003	32 48.685	103 36.718																		
36	1/23/2003	32 48.477	103 37.190															2			
37	1/23/2003	32 48.371	103 39.515																		
38	1/23/2003	32 48.269	103 40.061																		
39	1/23/2003	32 48.475	103 41.626																		
40	1/23/2003	32 49.093	103 42.697																		
41	2/11/2003	32 48.608	104 01.177																		
42	2/11/2003	32 48.040	104 01.176																		
43	2/11/2003	32 47.573	104 01.275																		
44	2/11/2003	32 45.843	104 01.181																		
45	2/11/2003	32 51.035	103 58.713																		
46	2/11/2003	32 52.047	103 58.331																		
47	3/4/2003	32 52.523	104 02.62																		
48	3/4/2003	32 50.91	104 02.241																		
49	3/4/2003	32 49.976	104 02.244																		
50	3/4/2003	32 49.413	104 02.222																		
51	4/3/2003	32 52.347	104 02.063																		
52	4/3/2003	32 52.348	104 00.571																		
53	4/3/2003	32 52.352	103 58.998																		
54	4/3/2003	32 52.419	103 58.162																		
55	4/3/2003	32 52.352	103 57.449																		
56	4/3/2003	32 52.360	103 56.776																		
57	4/3/2003	32 54.890	103 56.705																		
58	4/9/2003	32 52.904	103 55.585																		
59	4/9/2003	32 52.343	103 55.665																		
60	4/9/2003	32 51.924	103 55.657																		
61	4/9/2003	32 51.271	103 55.651																		
62	4/9/2003	32 50.826	103 55.649																		
63	4/9/2003	32 49.852	103 56.037																		
64	4/9/2003	32 49.280	103 56.179																		
65	4/9/2003	32 48.809	103 56.236																		
66	4/9/2003	32 48.229	103 56.169																		
67	4/9/2003	32 49.727	103 54.487																		
68	4/9/2003	32 50.327	103 54.884																		
69	4/9/2003	32 50.290	103 55.259												1						
70	4/9/2003	32 52.348	103 55.264																		
71	4/9/2003	32 52.039	103 54.801																		
72	4/16/2003	32 47.506	104 01.245																		
73	4/16/2003	32 45.703	104 01.181																		
74	4/16/2003	32 44.799	104 01.066																		
75	4/16/2003	32 47.487	104 00.742																		

Appendix C. Data Set for Disturbed Sites Including Survey Nu
Date, Latitude, Longitude, and Species Composition for Each S

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Survey #	Date	Latitude (Decimal Degrees)	Longitude (Decimal Degrees)	Northern Mocking Bird	Pyrrhuloxia	Red Tailed Hawk	Says Phoebe	Scaled Quail	Scissor Tailed Flycatcher	Virginia's Warbler	Varied Bunting	Vermillion Flycatcher	Western Kingbird	Western Meadow Lark	Western Scrub Jay	Western Wood Peewee	White Crowned Sparrow	White Winged Doved	Yellow Billed Cuckoo	Yellow Headed Black Bird	Yellow Rumped Warbler
76	4/24/2003	33 00.182	103 59.015																		
77	4/24/2003	32 56.831	103 58.885																		
78	4/24/2003	32 57.691	103 58.885																		
79	4/24/2003	32 57.365	103 57.992																		
80	4/24/2003	32 57.354	103 57.481																		
81	4/24/2003	32 56.944	103 54.179																		
82	4/24/2003	32 56.726	103 53.889					1													
83	4/24/2003	32 57.078	103 52.745																		
84	6/28/2003	32 45.112	103 53.141																		
85	6/28/2003	32 45.757	103 53.253																		
86	6/28/2003	32 45.160	103 52.621																		
87	6/28/2003	32 45.172	103 53.109																		
88	6/28/2003	32 44.570	103 53.167																		
89	6/28/2003	32 44.119	103 53.319																		
90	6/28/2003	32 43.214	103 53.105																		
91	6/28/2003	32 46.034	103 46.613																		
92	6/28/2003	32 46.253	103 46.162																		
93	6/28/2003	32 46.246	103 45.396																		
94	6/28/2003	32 46.252	103 44.863																		
95	6/28/2003	32 45.884	103 45.651																		
96	6/28/2003	32 45.027	103 45.927																		
97	6/28/2003	32 43.828	103 45.472																		
98	6/28/2003	32 43.646	103 46.089																		
99	7/17/2003	32 48.549	103 45.748																		
100	7/17/2003	32 48.552	103 45.257																		
101	7/17/2003	32 48.009	103 45.136																		
102	7/17/2003	32 48.968	103 52.215																		
103	7/17/2003	32 49.560	103 52.575																		
104	7/17/2003	32 49.757	103 52.799																		
105	7/17/2003	32 49.304	103 52.686																		
106	7/17/2003	32 48.958	103 54.395																		
107	7/17/2003	32 50.333	103 54.861																		
108	7/17/2003	32 50.836	103 55.644																		
109	7/17/2003	32 51.592	103 55.274																		
110	8/6/2003	32 45.626	103 36.409										1								
111	8/6/2003	32 44.697	103 36.544																		
112	8/6/2003	32 44.090	103 36.599																		
113	8/6/2003	32 43.622	103 35.854																		
114	8/6/2003	32 43.001	103 35.843										1								
115	8/6/2003	32 43.010	103 36.122																		
116	8/6/2003	32 42.772	103 36.597																		