South Bay Salt Pond Waterbird Surveys
September 2022 – May 2023

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Executive Summary

This report serves as a data summary and coarse-scale assessment of waterbird and water quality monitoring efforts at six pond complexes in the South San Francisco Bay. Coyote Hills, Dumbarton, and Mowry salt ponds are owned by Don Edwards San Francisco Bay National Wildlife Refuge and managed for salt production by Cargill Salt. Alviso and Ravenswood complexes are owned and managed by the U.S. Fish & Wildlife Service as part of the Don Edwards San Francisco Bay National Wildlife Refuge. Eden Landing Ecological Reserve (Eden Landing) ponds are owned and managed by California Department of Fish and Wildlife, with the exception pond CP3C, which is owned by Cargill Salt. This report is based primarily on data collected by the San Francisco Bay Bird Observatory between September 2022 and May 2023.

The purpose of this ongoing study is to describe avian use of ponds to guide regional waterbird conservation, management, and habitat restoration efforts. The South Bay Salt Pond Restoration Project (SBSPRP) is restoring 15,000 acres of former salt evaporation ponds to a mix of tidal marsh and enhanced managed pond habitats. Restoration and monitoring is entering its third decade, and long-term population analyses have shown declines in some species and guilds, but evidence of cyclical trends (regular increases and decreases) in others, which may be driven by climate patterns or density-dependent regulation. It is therefore important to determine the drivers of these long-term trends, and to contextualize local trends with population trends elsewhere in the range, to assess the likelihood that observed declines are driven by SBSPRP actions rather than other factors. Understanding how waterbirds use ponds, identifying key habitat associations, and incorporating features essential to pond-dependent species into restoration plans is important for helping maintain baseline numbers of waterbirds in the South Bay and recovering populations that have experienced long-term declines.

From September 2022 – May 2023, we conducted waterbird surveys and water quality sampling at 82 ponds (22 Cargill-managed salt production ponds and 60 SBSPRP-managed ponds). We examined species richness, abundance, and behavior of waterbird assemblages within and among pond complexes. We grouped species into guilds (e.g., dabbling ducks, diving ducks, gulls) based on foraging methods and prey requirements to understand waterbird use of these ponds. We used these data to assess long-term changes in waterbird numbers relative to baseline counts from before marsh restoration.

We recorded 1,246,072 waterbird observations of 82 species (all sites combined). The Alviso and Eden Landing pond complexes supported the greatest species diversity and Alviso had the highest abundances of all complexes. The abundance of 5 out of 7 currently tracked species/guilds has increased in SBSPRP ponds since prior to restoration activities in 2005–2007 (6 of 8, if counting small shorebirds in both the fall and spring). Exceptions comprise Bonaparte's gulls, dabbling ducks, and medium shorebirds; plus phalaropes, which supplemental summer surveys show have declined. For most of the species/guilds that increased in abundance across all ponds, the increases are largely due to higher counts within the SBSPRP area. This indicates long-term benefits of the project for many waterbird populations within South San Francisco Bay. However, 6 of the currently tracked fall/winter/spring taxa have declined in recent years, which is cause for caution. Only small shorebirds are currently stable (slightly increasing in fall and slightly declining in spring).

Two species/guilds have declined below trigger values defined in the Adaptive Management Plan: Bonaparte's gulls and phalaropes. In the previous year, Bonaparte's gull had declined by 84% relative to their baseline abundance, crossing the adaptive management plan's trigger threshold of >50% decline below the baseline in a single year, or >25% in three consecutive years. This winter, detections of Bonaparte's gull had increased from the previous year to an average of 763, but this still represents a decline of -40% and the running average two-year decline is -62% (winter 2021 and 2022 seasons; winter 2020 was not surveyed due to COVID-19 restrictions). Given that two other saline specialist guilds also show signs of decline within the

SBSPRP area–phalaropes have passed the trigger level, and eared grebes remain in salt production ponds but have dwindled in the SBSPRP footprint–the loss of high-salinity habitats is likely one of the causative factors.

We recommend special consideration should be given to habitat needs of phalaropes and Bonaparte's gulls, but note that these are poorly understood within the South San Francisco Bay ecosystem. More focused field studies on their habitat use and selection are needed to identify their habitat requirements and understand how to manage them effectively to recover these populations. In the meantime, we recommend cautiously maintaining a variety of water quality parameter levels in order to support guilds with different habitat requirements.

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Introduction

In 2002, the U.S. Fish and Wildlife Service (USFWS) and California Department of Fish and Wildlife (CDFW, formerly California Department of Fish and Game) entered into an historic agreement with Cargill Salt to acquire 15,100 acres of salt evaporator ponds in the South San Francisco Bay. The South Bay Salt Pond Restoration Project (SBSPRP) has begun to restore the area to a mix of tidal and ponded habitats while continuing to provide flood protection and improved public access to many sites.

Salt ponds have been present in the San Francisco Bay for over 150 years (Ver Planck 1958) and have significant wildlife value (Anderson 1970, Accurso 1992, Takekawa et al. 2001, Warnock et al. 2002). Due to the loss of wetlands elsewhere, the ponds now provide important foraging and roosting areas for many waterbirds. As a major migratory and wintering location along the Pacific Flyway, the San Francisco Bay supports more than a million birds throughout the year (Page et al. 1999, Warnock et al. 2002). The SBSPRP has committed to restoring some ponds to tidal marsh, while retaining some pond habitat (as managed enhanced ponds) within the project area for waterbirds. Information is needed to ensure that habitat requirements of large numbers of waterbirds can be met with reduced pond acreage, including both salt production ponds and wildlife managed ponds.

The objectives of this ongoing study are to document avian use of current and former salt evaporation ponds in the South San Francisco Bay and to use data collected on waterbird abundance, distribution, and habitat associations to inform regional conservation, management, and habitat restoration efforts. Prior to October 2013, two entities, the U.S. Geological Survey (USGS) and San Francisco Bay Bird Observatory (SFBBO), conducted monthly waterbird surveys and water quality sampling at South Bay ponds. USGS monitored those ponds located within the SBSPRP footprint, while SFBBO monitored those ponds managed by Cargill Salt for salt production. From October 2013 – January 2014 no waterbird surveys were conducted while the project was in transition. Beginning in January 2014, SFBBO conducted waterbird surveys and water quality sampling at all South Bay ponds (Cargill-managed and SBSPRP ponds). Surveys from January 2014 – November 2017 were conducted twice during the spring, fall, and winter seasons and once during the summer season. No Surveys were completed from February 2018 – December 2018. The survey from December 2018 – mid-January 2019 was canceled after counts occurred at four ponds due to funding restrictions; these data are excluded from summary figures. From mid-January 2019 to February 2020, surveys were conducted twice per season in winter, spring, and fall at all 82 accessible ponds. Due to site access limitations associated with the COVID-19 pandemic, 45 ponds were surveyed from March to April 11, 2020 and the 25 ponds within Eden Landing Ecological Reserve were surveyed from April 15 to May 2020 and December 2020 to February 2021 (Tarjan & Burns 2021a). Beginning in September 2021, regular surveys were conducted twice in the fall, winter, and spring at all 82 ponds.

Restoration and monitoring is entering its third decade, and long-term population analyses have shown declines in some species and guilds, but evidence of cyclical trends (regular increases and decreases) in others, which may be driven by climate patterns or density-dependent regulation. It is therefore important to determine the drivers of these long-term trends, and to contextualize local trends with population trends elsewhere in the range, to assess the likelihood that observed declines are driven by SBSPRP actions rather than other factors. Understanding how waterbirds use ponds, identifying key habitat associations, and incorporating features essential to pond-dependent species into restoration plans is important for helping maintain baseline numbers of waterbirds in the South Bay and recovering populations that have experienced long-term declines.

This report summarizes the results of SFBBO's surveys in the South San Francisco Bay pond complexes from September 2022 to May 2023 (Table 1).

Methods

Study Area

The study area includes 82 current and former salt ponds in the Santa Clara, Alameda and San Mateo counties of California. The ponds monitored by SFBBO include 25 ponds in the Alviso complex, 12 ponds in the Coyote Hills complex, 4 ponds in the Dumbarton complex, 25 ponds in the Eden Landing complex (pond CP3C is owned by Cargill Salt), 6 ponds in the Mowry complex and 10 ponds in the Ravenswood complex (Figure 1). Although the Coyote Hills, Dumbarton, and Mowry ponds are owned by Don Edwards San Francisco Bay National Wildlife Refuge, Cargill Salt retains salt-making rights and regulates water flow for salt production. The salinity and depth of all surveyed ponds varied over the course of the year due to management practices and business needs of these organizations.

Waterbird Surveys

We conducted waterbird surveys at each of the 82 ponds in the Alviso, Coyote Hills, Dumbarton, Eden Landing, Mowry, and Ravenswood complexes. We performed surveys exclusively at high tide, defined as a tide of 4.0 ft or greater at the Alameda Creek Tide Sub-Station (37° 35.70' N, 122° 08.70' W). During each survey, we observed birds from the nearest drivable road or levee using spotting scopes and binoculars. Beginning in fall 2021, we surveyed pond A19 from the Newby Island Landfill, which substantially increased the area of this tidally restored pond that was visible to surveyors; further breaches were completed in 2021 to accelerate tidal marsh establishment. We counted the total number of individuals of all waterbird species present on each pond and recorded the location of each using aerial site photos superimposed with 250x250 m^2 individually labeled grids through January 2018. Bird observations were assigned to sites and not grids starting in January 2019. For each sighting of an individual bird or bird group of the same species, we recorded behavioral data (whether the bird or bird group was foraging or roosting). For roosting birds only, we recorded whether we observed the bird or bird group on a levee, an island, or a manmade/artificial structure (e.g., blind, fence post). Pond surveys were randomized as follows: ponds were split into 6 groups based on geographic location and pond complex (Newark & Mowry, Northern Eden Landing, Southern Eden Landing, Ravenswood, Western Alviso, Eastern Alviso), a random list of these groups was generated, field crews surveyed any accessible ponds within 1 area each survey day and moved to the next area if no ponds were accessible in that area. Each survey round lasted 6 weeks, during which all ponds were visited. Exceptions to this survey schedule occurred in past years due to changes in funding and land access restrictions due to COVID-19.

We identified birds to the species level whenever possible, with the exception of long-billed and short-billed dowitchers (identified as "dowitchers"), and greater and lesser scaup (identified as "scaup"). When species identification was not possible, we identified birds to genus (e.g., *Calidris*) or foraging guild (e.g., gulls, small shorebirds, medium shorebirds, phalaropes).

Water Quality Sampling

During each bird survey, we recorded water levels by reading the water level on staff gauges if present. See Table 2 for a list of all ponds and 2023 staff gauge statuses. On occasion, staff gauges were removed, replaced, or moved to a different location. We assumed that staff gauges were redeployed in a standardized manner, and therefore that staff gauge levels are comparable before and after all changes within a pond. In ponds with multiple staff gauges, we recorded only the master staff gauge (indicated by a circle of yellow paint on the gauge post). Observers also visually estimated the proportion of any pond substrate exposed to the air (dry pond bottom or mudflat exposed) to provide a finer-scale characterization of habitat variability.

Water quality samples were collected from the surface of the water (depth of <0.5 m). The number of sampling points per pond varied based on the size, configuration, and accessibility of the pond. As of spring 2023, most of the 82 total ponds had three (32 ponds, 39%) or two (21 ponds, 26%) sampling points, but a few had one (14 ponds, 17%) or four (12 ponds, 15%). Three ponds (A8W, E8AE, E8AW; 3%), had no water quality points due to inaccessibility of the water surface (e.g., due to being restored to tidal marsh). Some sampling points could also temporarily not be reached due to low water levels within the pond during some surveys. Whenever possible, water quality data was collected on the day of the bird survey, but otherwise was collected as close to the date of the bird survey as possible. We recorded dissolved oxygen, salinity, conductivity, pH, and temperature at 1-4 pre-determined sampling sites at each pond using a Hydrolab Minisonde (Hydrolab-Hach Company, Loveland, CO). When salinities exceeded approximately 72 ppt (the maximum value registered by the Hydrolab Minisonde), we calculated salinity using a hydrometer (Ertco, West Paterson, NJ) to measure specific gravity in combination with a temperature reading from the water sample. Additionally, we recorded barometric pressure at the beginning of each day that we collected water quality samples. We calibrated all Hydrolab Minisonde sensors before the start of each sampling day. We followed water quality monitoring methods outlined by Murphy et al. (2007).

Data Summary

Species Richness

We calculated species richness as the total number of waterbird species observed (with dowitchers and scaup each counting as one "species" because individual species were not distinguished for those taxa) at each pond and pond complex across all surveys from September 2022 to May 2023.

Abundance

We calculated abundance as the sum of all bird sightings for each species or guild encountered across all surveys from September 2022 to May 2023. We calculated abundance at the pond and complex levels. Due to site fidelity of many birds, we believe that the same individuals were likely re-sighted on surveys close together in time and space, so abundance estimates in this report should be interpreted carefully. As treated here, abundance estimates represent aggregated ground counts, or the total bird sightings (as summed across all surveys) for a given location and period of time.

Behavior

Of the total bird sightings (across all surveys), we calculated the proportions of birds observed foraging, roosting, and resting on islands, levees, and manmade structures for each pond. We also examined these proportions at the guild level (see Guilds below).

Guilds

We categorized each species into a foraging guild based on foraging methods and prey requirements (see Appendix I). Guilds of primary interest include dabbling ducks (dabblers), diving ducks (divers), eared grebes, fish-eating birds (fisheaters), gulls, herons and egrets, medium shorebirds, phalaropes, small shorebirds, and terns. We calculated abundance by guild for each site within the survey area, and then used these abundances to create guild-specific maps of abundance distributions using ggplot2 in R version 3.5.1 (R Development Core Team 2018). We also examined guild abundance by pond, complex, season, and year. For analyses that utilized data from multiple years, we defined years as the year in which the study year started. 2005: September 2005 to August 2006; 2006: September 2006 to August 2007; 2007: September 2007 to August 2008; 2008: September 2008 to August 2009; 2009: September 2009 to August 2010; 2010: September 2010 to August 2011; 2011: September 2011 to August 2012; 2012: September 2012 to August 2013; 2013: September 2013 to August 2014; 2014: September 2014 to August 2015; 2015: September 2015 to August 2016; 2016: September 2016 to August 2017; 2017: September 2017 to January 2018; 2018: January 2019 to May 2019, due to a hiatus in surveys from

January 2018 to December 2018; 2019: September 2019 to May 2020; 2020: December 2020 to February 2021, due to a hiatus in surveys from September 2020 to November 2020; 2021: September 2021 to May 2022; and 2022: September 2022 to May 2023. We defined seasons as fall (September, October, and November), winter (December, January, and February), spring (March, April, and May), and summer (June, July, and August). Prior to 2013, the annual reports covered a period from October to September. For the fall season, this meant that data collected in October and November 2011 (for example) were lumped together with data from September 2012. In the 2013 report, we shifted the reporting period to September – August to match our seasonal definitions and to facilitate data interpretation. In 2021 we added quarterly reports each season to provide timely information to land managers.

Water Quality

We calculated average salinity, temperature, dissolved oxygen, pH, and water level (based on staff gauge values) for each pond by averaging values taken across all sampling locations within that pond during the survey period. For the purposes of this report, and for consistency with past SFBBO reports, we confined our summary primarily to full water quality sampling events. Staff gauge values were averaged between all surveys (bird surveys and water quality surveys), but treated as a single value due to potential duplication of data between tables. If ponds were dry enough that no water reached the staff gauge, we did not record any staff gauge reading. For each complex, we calculated average salinity for each season (using the season definitions above). In addition, for discussion purposes, we characterized each pond as low (0-60 ppt), moderate (61-120 ppt), or high (>120 ppt) salinity by averaging means across the study period.

Long-term Trends

We visualized waterbird trends by selecting the counts within the peak season for each species/guild (i.e. the season when the species/guild was most abundant) and compared the fits of linear and nonlinear models in R version 3.5.1 (R Development Core Team 2018). Upon inspection of the data and model fits, linear models proved insufficient to capture long-term nonlinear trends for these species. We next compared two methods of characterizing nonlinear trends: non-parametric locally weighted smoothing (LOESS) in the ggplot2 package (Wickham 2016) and Generalized Additive Models (GAM) using the gam package. GAMs were more sensitive to count variability in the data, and the ability to include additive effects was unnecessary in the absence of covariates. We therefore used LOESS regression for the purpose of illustrating overall trends in counts (De La Cruz 2018).

We assessed directional changes in counts over time by comparing the most recent three-year average of complete counts to baseline counts or NEPA/CEQA targets when applicable. NEPA/CEQA targets were used for this assessment for each guild/species addressed in the Adaptive Management Plan (Appendix I in Tarjan 2021). For guilds/species that were not included in the Adaptive Management Plan, we defined baseline values as the mean count per survey from 2005–2007, which is the earliest period for which counts are available in both the SBSPRP area and salt production ponds.

Results & Discussion

Overall, we recorded 1,246,072 waterbird sightings of 82 species in the Alviso, Coyote Hills, Dumbarton, Eden Landing, Mowry, and Ravenswood pond complexes from September 2022 to May 2023 (Table 3, Figure 1). Abundance and richness of waterbird species were directly related: the Alviso complex supported the highest overall bird count and the highest species richness, while the Dumbarton complex had both the lowest overall bird count and the lowest species richness. Most guilds showed patchy abundance distributions (Figure 2 – Figure 12), suggesting differential use of habitat within and between ponds. This is consistent with the findings of studies of waterbird use of Cargill-managed and SBSPRP-managed ponds (e.g., Murphy et al. 2007, Robinson-Nilsen et al. 2009, Robinson-Nilsen and Demers 2012b, Donehower et al. 2013, De La Cruz et al. 2018). We observed birds foraging and roosting in all complexes to varying degrees, and at some ponds, particular guilds used islands, levees, and manmade structures extensively for roosting (Table 4). Many guilds also exhibited intra- (Figure 13 – Figure 18, Figure 19 – Figure 28b) and inter-annual (Figure 19 – Figure 28 a, c) fluctuations in abundance. Seasonal differences are to be expected for many species, such as migratory shorebirds and waterfowl, and wildlife frequently experience cyclical population dynamics; therefore, a larger landscape context will be needed for separating annual variation and site-level changes from population-level phenomena (Coates et al. 2021).

Due to their connectedness, ponds in the same general area exhibited similar water quality patterns. In the salt-production pond complexes (Coyote Hills, Dumbarton and Mowry) salinity tended to increase as water moved through the system, though in spring all Mowry ponds converged on similar salinities (Figure 32). The least saline ponds were often tidal, including A19 (fully tidal) and A8 (muted tidal), though E2C (a managed pond) was an exception; the most saline ponds was A12, which had its water levels drawn down for construction of the Shoreline Project, followed by R2 and RSF2U3 (Figure 30 – Figure 33). Previous and current surveys show that seasonal fluctuations occur in salinity and water temperatures; with lower salinities and colder temperatures in the winter months and higher salinities with warmer temperatures in the fall or summer months (Figure 30 – Figure 37); we observed particularly dramatic increases in salinity in the spring in salt production ponds NPP1, N1A–N4Ab complex, and M1–M2 (Figure 32). Since cold water tends to hold more dissolved oxygen than warm water, ponds tended to show higher dissolved oxygen concentrations in winter months than in summer months, though this pattern varied significantly from pond to pond (Figure 38 – Figure 41). pH values varied between ponds, but did not generally show seasonal fluctuations (Figure 42 – Figure 45). Influxes of water from rainfall and management practices, time-of-day effects, algal blooms, and rates of photosynthesis and respiration by aquatic biota may also have contributed to fluctuations in water quality parameters. The latter three factors can be particularly important determinants of dissolved oxygen levels and pH (Carpelan 1957).

The following ponds within the study area did not have staff gauges present for the entire study period: A10, A11, A12, A19, A22, A23, A2E, A6S, A8, A8S, A8W, N4AB, N4B, NPP1, E4C, E6, E7, E8AE, E8AW, R3, R4, R5, R5S (Table 2). Several ponds were often dry enough that no water reached the staff gauge; therefore, no staff gauge reading is available for that survey period.

Alviso

Species Richness, Abundance, and Behavior.

From September 2022 to May 2023, we documented 448,318 sightings of 70 species in the Alviso pond complex (Table 3). By complex, Alviso ranks number 1 for waterbird abundance and number 1 for species richness. Alviso ponds contained 36% of all sightings and comprised 36.4% of the total study area (Table 3). Pond A9 was the most used pond in Alviso based on overall bird counts (92,117 sightings). Compared to other complexes, the Alviso ponds supported the highest proportion of terns (50.8%), herons and egrets (53.9%), gulls (49.1%), fisheaters (60.2%), diving ducks (60.6%), and dabbling ducks (51.9%; Figure 29).

Water Quality.

Average salinities in the Alviso complex ranged from 0.52 ppt (A19, spring) to 307 ppt (A12, fall) (Figure 30). Average salinity tended to be highest in the fall and summer survey periods, with the minimum occurring in either the winter or spring survey periods (Figure 30). Temperature followed the general expected seasonal pattern and was also likely influenced by salinity and by time of day (Figure 34). Average dissolved oxygen concentrations ranged from a low of 2.37 mg/L (A22, fall) to a high of 26.62 mg/L (A8S, winter; Figure 38). Average pH values ranged from a low of 6.92 in A15 in fall to a high of 9.38 in A16 in spring, and generally did not display strong seasonal patterns (Figure 42). Staff gauge levels ranged in the Alviso complex from -2.7 ft at A3W in spring, to 8.6 ft in A17 in winter (Figure 46). Staff gauges are not present in several ponds in the Alviso complex: A10, A11, A12, A19, A22, A23, A2E, A6S, A8, A8S, and A8W. Pond A19 was visited on days when water quality equipment malfunctioned, so no water quality information is available during certain surveys.

Coyote Hills

Species Richness, Abundance, and Behavior.

From September 2022 to May 2023, we documented 83,349 sightings of 61 species in the Coyote Hills complex (Table 3). By complex, Coyote Hills ranks number 5 for waterbird abundance and number 3 for species richness. There is little shallow habitat for shorebirds roosting in the Coyote Hills complex; therefore, it is rare for medium or small shorebird flocks to be present. Coyote Hills salt ponds contained only 6.7% of all sightings, but comprised 12.9% of the total study area (Table 3). Pond N3A was the most used pond in the complex based on overall bird counts (19,639 sightings). Compared to other complexes, no guilds had their highest proportion of sightings within the Coyote Hills complex (Figure 29).

Water Quality.

As in past years, the Coyote Hills complex was characterized by a series of relatively low salinity ponds. The more northern ponds tend to be less saline and salinity increases in the southern ponds. Average salinities ranged from 18.75 ppt (N4B, winter) to 69.67 ppt (N5, fall; Figure 32). All ponds followed a similar seasonal pattern with the minimum in winter and a maximum generally in summer or fall (Figure 32). Temperature followed the general expected seasonal pattern and was also likely influenced by salinity and by time of day (Figure 36). Average dissolved oxygen concentrations ranged from a low of 0.81 mg/L (N6, fall) to a high of 17.56 mg/L (N4B, winter; Figure 40). Average pH values ranged from a low of 7.18 in N4AB in winter to a high of 9 in N5 in fall and generally did not display strong seasonal patterns (Figure 44). Staff gauge levels ranged from 1 ft at N7 in fall, to 7.7 ft in N5 in spring (Figure 48). Staff gauges are not present in the following ponds in the Coyote Hills complex: N4AB and N4B.

Dumbarton

Species Richness, Abundance, and Behavior.

From September 2022 to May 2023, we documented 59,083 waterbird sightings of 40 species in the Dumbarton complex (Table 3). By complex, Dumbarton ranks number 6 for waterbird abundance and number 6 for species richness. Dumbarton salt ponds contained 4.7% of all waterbird sightings and comprised 6.3% of the total study area (Table 3). Pond NPP1 was the most used based on overall bird counts (25,450 sightings). Like Coyote Hills, no guilds had their highest proportion within the Dumbarton pond complex (Figure 29).

Water Quality.

The Dumbarton complex was characterized by moderate salinities, and salinity tended to increase as water moved east within the system (Figure 32). Average salinities ranged from 45.22 ppt at N3 in winter to 149.75 ppt at NPP1 in spring. All ponds followed a similar seasonal pattern with the minimum in winter and a maximum generally in summer or fall (Figure 32). Temperature followed the general expected seasonal pattern and was also likely influenced by salinity and by time of day (Figure 36). Average dissolved oxygen concentrations ranged from a low of 3.35 mg/L (NPP1, fall) to a high of 10.83 mg/L (N1, fall; Figure 40). Average pH values ranged from a low of 7.33 in NPP1 in spring to a high of 8.45 in N2 in winter and generally did not display strong seasonal patterns (Figure 44). Staff gauge levels ranged from 1.1 ft at N1 in fall, to 3.9 ft in N2 in winter (Figure 48). Staff gauges are present and functional on all ponds in the Dumbarton complex except NPP1.

Eden Landing

Species Richness, Abundance, and Behavior.

From September 2022 to May 2023, we documented 326,441 waterbird sightings of 67 species in the Eden Landing pond complex (Table 3). By complex, Eden Landing ranks number 2 for waterbird abundance and number 2 for species richness. Eden Landing ponds contained 26.2% of all sightings and comprised 22.6% of the total study area (Table 3). Pond E9 was the most used based on overall bird counts (43,998 sightings). Compared to other complexes, the Eden Landing ponds supported the highest proportion of small shorebirds (33.8%), phalaropes (83.7%), and medium shorebirds (35.1%; Figure 29).

Water Quality.

The Eden Landing complex was characterized by mostly low to moderate salinities, with one high salinity pond (E6C) (Figure 31). Average salinities ranged from 0.66 ppt at E2C in spring to 263 ppt at E6C in fall. Salinities generally followed the expected seasonal pattern of peak salinities in summer or fall and lowest salinities in winter. Temperature followed the general expected seasonal pattern and was also likely influenced by salinity and by time of day (Figure 35). Average dissolved oxygen concentrations ranged from a low of 1.28 mg/L (E4C, fall) to a high of 24.12 mg/L (E7, winter) (Figure 39). Average pH values ranged from a low of 6.77 in E9 in winter to a high of 9.17 in E2 in fall and generally did not display strong seasonal patterns (Figure 43). Staff gauge levels ranged from 0.6 ft at E11 in fall, to 7.3 ft in E12 in winter (Figure 47). Staff gauges are not present in the following ponds at the Eden Landing complex: E4C, E6, E7, E8AE, and E8AW.

Mowry

Species Richness, Abundance, and Behavior.

From September 2022 to May 2023, we documented 127,957 waterbird sightings of 44 species in the Mowry complex (Table 3). By complex, Mowry ranks number 4 for waterbird abundance and number 5 for species richness. Mowry salt ponds contained 10.3% of all waterbird sightings and comprised 14.4% of the total study area (Table 3). Pond M2 was the most used based on overall bird counts (30,677 sightings). Compared to other complexes, the Mowry ponds supported the highest proportion of eared grebes (88.5%; Figure 29).

Water Quality.

The Mowry complex was characterized by moderate to high salinity ponds; salinity increased as water moved east within the system (Figure 32). M1, M2, and M3 generally had lower salinity than M4, M5, and M6, though they converged to similar salinity levels in spring. Average salinities ranged from 44.4 ppt at M1 in fall to 251 ppt at M6 in fall. This complex sees less of a seasonal swing in salinities, though

M1 and M2 were notable exceptions this year due to dramatic increases in the spring. Temperature followed the general expected seasonal pattern and was also likely influenced by salinity and by time of day (Figure 36). Average dissolved oxygen concentrations ranged from a low of 3.33 mg/L (M6, fall) to a high of 12.5 mg/L (M6, winter) (Figure 40). Average pH values ranged from a low of 7.2 in M6 in fall to a high of 8.47 in M2 in winter and generally did not display strong seasonal patterns (Figure 44). Staff gauge levels ranged from 2.4 ft at M5 in fall, to 5.4 ft in M6 in spring (Figure 48). All Mowry ponds have staff gauges.

Ravenswood

Species Richness, Abundance, and Behavior

From September 2022 to May 2023, we documented 200,924 waterbird sightings of 57 species in the Ravenswood complex (Table 3). By complex, Ravenswood ranks number 3 for waterbird abundance and number 4 for species richness. Ravenswood ponds contained 16.1% of all waterbird sightings and comprised 7.3% of the total study area (Table 3). Pond R1 was the most used based on overall bird counts (131,345 sightings). No guilds had their highest proportion of sightings within the Ravenswood ponds (Figure 29).

Water Quality

The Ravenswood complex was characterized by three low salinity ponds (RSF2U1, U2 and U4) and seven high salinity ponds (Figure 33). The ponds on the north end of the complex tend to be the highest salinities and the RSF2 ponds on the south end of the complex tend to be the lowest salinity, with the exception of RSF2U3. Salinities in this complex ranged widely throughout the season, from 9.1 ppt at RSF2U1 in winter to 307 ppt at R2 in fall. Temperature followed the general expected seasonal pattern and was also likely influenced by salinity and by time of day (Figure 37). Average dissolved oxygen concentrations ranged from a low of 1.99 mg/L (R5S, fall) to a high of 20.45 mg/L (RSF2U1, winter; Figure 41). Average pH values ranged from a low of 5.64 in R5 in fall to a high of 9.15 in RSF2U1 in winter and generally did not display strong seasonal patterns (Figure 45). Staff gauge levels ranged from often dry on ponds R1–R3 to 6.1 ft in RSF2U2 in fall (Figure 49). Staff gauges are always dry or inaccessible on ponds R4, R5 and R5S.

Guilds

Overall Patterns

This year, several unusually severe winter storms hit the San Francisco Bay Area, and corresponded with a delay in nesting in many colonial waterbirds and snowy plovers (SFBBO, unpublished data). Nevertheless, winter abundances of birds within each complex were as expected, with almost all guilds was solidly within the normal range observed in recent years (since 2016), except fisheaters, who had their lowest recorded observations during this period (Figures 19–28). There was slightly more evidence for an impact on spring abundances, as several guilds—dabbling ducks, diving ducks, eared grebes, and gulls—had their highest spring abundances since 2016 or earlier. A potential explanation for this increase in sightings is that these guilds may have delayed spring migration due to the winter storms, lingering on ponds longer than usual. However, medium shorebirds had their lowest spring since before 2016 (Figure 26), and other guilds had spring abundances within their normal recent range, so the evidence for this effect is not particularly strong.

Dabblers

Across all complexes, a total of 188,420 dabbling ducks were observed during the survey period. By complex, abundance of dabbling ducks was highest in Alviso ponds A16, A14, and A9; Coyote Hills pond N4AA; Dumbarton pond N3; Eden Landing ponds E4 and E6A; Mowry pond M5; and Ravenswood pond RSF2U2 (Table 5, Figure 3, Figure 19). Over all complexes, A16 had the highest total count (21,133 observations), followed by A14 (14,782) and A9 (12,737). At Ponds A16, A14, and A9, we observed the majority of dabbling ducks roosting on the pond surface (68.2%, 77.6%, and 74.6%, respectively; Table 5). Previous reports found that foraging and roosting dabbling ducks were most abundant on ponds with low salinity (≤33 ppt), and roosting dabbling ducks declined in abundance as levees open to hunting increased (De La Cruz et al. 2018). Dabbling ducks were not sensitive to other water quality parameters, indicating that they may be flexible with respect to different water quality parameters (Scullen et al. 2013).

Divers

Across all complexes, a total of 227,577 diving ducks were observed during the survey period. By complex, abundance of diving ducks was highest in Alviso ponds A3W, A14, and A8; Coyote Hills pond N3A; Dumbarton pond N1; Eden Landing ponds E2 and E7; Mowry pond M1; and Ravenswood pond R1 (Table 6, Figure 4, Figure 20). Over all complexes, A3W had the highest total count (16,865 observations), followed by A14 (16,614) and A8 (14,908). At Ponds A3W, A14, and A8, we observed the majority of diving ducks roosting on the pond surface (88.6%, 93.8%, and 93.4%, respectively; Table 6). Previous reports found that diving ducks demonstrated a significant increase in abundance with increases in dissolved oxygen or staff gauge levels (at the grid level, abundance was highest at 0.33 – 2.51 m deep; De La Cruz et al. 2018) and a significant decrease in abundance with increases in salinity (Scullen et al. 2013). Diving ducks were also most abundant in the largest ponds and at lower abundance in breached ponds (De La Cruz et al. 2018).

Eared Grebes

As the SBSPRP continues, state and federal land managers are concerned that the loss of medium and high salinity ponds may impact species like eared grebes that depend on these habitats. Eared grebes show a significant increase in abundance with increases in pH, salinity, or staff gauge values; and decrease significantly in abundance with increasing temperature (Scullen et al. 2013). Across all complexes, a total of 49,509 eared grebes were observed during the survey period. By complex, abundance of eared grebes was highest in Alviso ponds A14, A8S, and A5; Coyote Hills pond N4; Dumbarton pond N1; Eden Landing ponds E6 and E6A; Mowry pond M4; and Ravenswood pond R4 (Table 7, Figure 5, Figure 21). Over all complexes, M4 had the highest total count (19,214 observations), followed by M5 (9,145) and M3 (8,771). At Ponds M4, M5, and M3, we observed the majority of eared grebes roosting on the pond surface (86.1%, 72.3%, and 63.5%, respectively; Table 7).

Fisheaters

Across all complexes, a total of 17,395 fisheaters were observed during the survey period. By complex, abundance of fisheaters was highest in Alviso ponds A11, A7, and A5; Coyote Hills pond N3A; Dumbarton pond N3; Eden Landing ponds E1 and E7; Mowry pond M1; and Ravenswood pond R1 (Table 8, Figure 6, Figure 22). Over all complexes, A11 had the highest total count (1,337 observations), followed by A7 (1,297) and A5 (1,288). At Ponds A11, A7, and A5, we observed the majority of fisheaters roosting on levees (58.4%, 84.3%, and 73.8%, respectively; Table 8). Fish cannot survive in salinities greater than 80 ppt (Carpelan 1957), which limits the salinity range where we would expect to observe fish-eating birds foraging, and fisheaters have showed a significant decrease in abundance with increases in dissolved oxygen or salinity (Scullen et al. 2013). They increase with increases in staff gauge values (i.e., higher water levels; Scullen et al. 2013)

Gulls

Across all complexes, a total of 85,027 gulls were observed during the survey period. By complex, abundance of gulls was highest in Alviso ponds A5, AB2, and A12; Coyote Hills pond N6; Dumbarton pond N2; Eden Landing ponds E6 and CP3C; Mowry pond M4; and Ravenswood pond R1 (Table 9, Figure 7, Figure 23). Over all complexes, A5 had the highest total count (5,628 observations), followed by AB2 (5,452) and A12 (5,259). At Ponds A12, A5, and AB2, we observed the majority of gulls roosting on levees (74.2%, 93.1%, 71.6%, respectively; Table 9). Previous reports found that gulls showed a significant increase in abundance with increases in pH, salinity, or staff gauge levels (Scullen et al. 2013). We consistently observe gulls foraging in high numbers at medium and high salinity ponds (e.g., R4, E6C, M6, and E5), likely on the abundance of brine shrimp and brine flies at these locations.

During the winter months, California gulls are present along with 7 other gull species (Tarjan & Burns 2021b). The presence of gulls on levees in the spring is largely due to summer California Gull breeding colonies. We also assessed breeding abundance of California gulls based on supplementary surveys of their breeding colonies within South Bay in May 2023 (Appendix II). Known and surveyed colonies included the levees and islands around A1, the A5/A7/A8, A9/A10/A11/A14, AB2, the M1/M2, M3, M4/M5, N2A/N3A/N4AB, N6/N7/N8/N9, RSF2, and the Palo Alto Flood Control Channel (PAFCC). We estimated 45,700 California gulls nested in the South San Francisco Bay in 2023, a decrease of -3.1% from the previous year (Appendix II). The A1 and A9/A10/A11/A14 colonies continued to be inactive (≤1 since 2018 and 2019, respectively), with the A1 roosting islands entirely eroded by winter storms. The M3 colony also was inactive, after having 2,205 nests the previous year, which corresponded to an increase in the M4/M5 colony from 52 to 1,489 nests (though this is still lower than historic highs at this colony; Appendix II). The only other colony that experience a >100% increase was RSF2, where the number of nests increased from 45 to 641. Hazing was conducted at this pond in mid-May to discourage further nesting in this area due to nearby sensitive Forster's tern and snowy plover nesting areas.

Herons and Egrets

Across all complexes, a total of 2,607 herons and egrets were observed during the survey period. By complex, abundance of herons and egrets was highest in Alviso ponds A16, A9, and AB1; Coyote Hills pond N4B; Dumbarton pond N3; Eden Landing ponds E6A and E1; Mowry pond M1; and Ravenswood pond R1 (Table 10, Figure 8, Figure 24). Over all complexes, A16 had the highest total count (193 observations), followed by R1 (181) and A9 (179). At Ponds A16, R1, and A9, we observed the majority of herons and egrets foraging (58.0%, 68.0%, and 89.9%, respectively; Table 10). Previous reports showed that herons and egrets decrease in abundance with increases in salinity or staff gauge values (Scullen et al. 2013). Higher salinity levels (above 80 ppt) are generally detrimental to fish survival (Carpelan 1957), and fish are a primary prey item for herons and egrets. Increased pond depths may allow fish to escape beyond the reach of herons and egrets, while shallow ponds may provide either a better or larger area of foraging habitat.

Phalaropes

Across all complexes, a total of 5,070 phalaropes were observed during the survey period. By complex, phalaropes were observed in Alviso ponds A22 and A9; Coyote Hills pond N4; Eden Landing ponds E4 and E2; Mowry pond M2; and Ravenswood pond R1 (Table 11, Figure 9, Figure 25).

Over all complexes, E4 had the highest total count (2,611 observations), followed by E2 (1,056) and M2 (491). At Ponds E4, E2, and M2, we observed the majority of phalaropes foraging (100.0%, 90.5%, and 100.0%, respectively; Table 11). Like eared grebes, land managers are concerned that the loss of medium and high salinity ponds may impact phalaropes, which depend on highly saline bodies of water that host brine flies and brine shrimp (Cullen et al. 1999). Notably, these three most abundant ponds had low- to moderate salinity compared to other ponds in their complexes (Figures 32–33), a result also seen in dedicated phalarope surveys (Burns et al. 2023). Since the onset of this project in 2005, sightings of phalaropes have fluctuated widely (e.g., over 10,000 observations in the 2006-2007 study year, versus fewer than 1,000 in the 2009-2010 study year; Figure 26 a). Since pond surveys are poorly timed to capture comparable counts during peak phalarope migration, we have conducted targeted phalarope migration surveys starting in 2019 (Tarjan & Burns 2021a, Burns et al. 2023). Analysis of these improved data have shown that the phalarope counts remain >70% below the baseline abundance, beyond the action trigger of 50% below the baseline, regardless of the approach used to correct for potential sampling biases (Burns and Van Schmidt 2023). We advise using these targeted phalarope surveys as the primary basis for drawing conclusions about trends in phalarope population dynamics locally and regionally to best design management actions to benefit phalarope populations within the SBSPRP footprint (Burns et al. 2023), and caution against over-interpreting the trends from general waterbird surveys.

Medium Shorebirds

Across all complexes, a total of 122,331 medium shorebirds were observed during the survey period. By complex, abundance of medium shorebirds was highest in Alviso ponds A9, A17, and A22; Coyote Hills pond N4; Dumbarton pond N3; Eden Landing ponds E9 and E11; Mowry pond M2; and Ravenswood pond RSF2U2 (Table 12, Figure 10, Figure 26). Over all complexes, RSF2U2 had the highest total count (14,620 observations), followed by E9 (12,427) and A9 (9,098). At Ponds E9, A9, and RSF2U2, we observed the majority of medium shorebirds roosting on the pond surface (94.9%), roosting on the pond surface (52.5%), and roosting on islands (92.4%), respectively (Table 12). Previous reports showed that at the pond scale medium shorebirds were associated with widely varying topography and the presence of islands (De La Cruz et al. 2018). Islands and levees in the ponds may therefore offer high tide refugia for shorebirds in the San Francisco Bay.

Small Shorebirds

Across all complexes, a total of 541,273 small shorebirds were observed during the survey period. By complex, abundance of small shorebirds was highest in Alviso ponds A9, A15, and AB2; Coyote Hills pond N9; Dumbarton pond NPP1; Eden Landing ponds E9 and E4C; Mowry pond M2; and Ravenswood pond R1 (Table 13, Figure 11, Figure 27). Over all complexes, R1 had the highest total count (120,502 observations), followed by A9 (65,447) and E9 (26,905). At Ponds R1, A9, and E9, we observed the majority of small shorebirds roosting (59.9%), roosting (59.1%), roosting (58.4%), respectively (Table 13). Previous reports found that small shorebirds showed a significant increase in abundance with increases in salinity or temperature and a significant decrease in abundance with increases in pH (Scullen et al. 2013). Compared with other guilds considered previously, foraging small shorebirds (not including least sandpiper) was the only guild with a higher abundance in breached ponds (De La Cruz et al. 2018).

Terns

Across all complexes, a total of 6,083 terns were observed during the survey period. By complex, abundance of terns was highest in Alviso ponds A16, A14, and A8S; Coyote Hills pond N4AA; Dumbarton pond N1; Eden Landing ponds E7 and E2; Mowry pond M2; and Ravenswood pond RSF2U2 (Table 14, Figure 12, Figure 28). Over all complexes, E7 had the highest total count (758 observations), followed by A16 (646) and N4AA (490). At Ponds N4AA, A16, and E7, we observed the majority of terns roosting on the pond surface (40%), roosting on islands (49.4%), and roosting on manmade structures (89.7%), respectively (Table 14). Previous reports found that terns were most abundant in large ponds with lower salinity (De La Cruz et al. 2018), possibly due to the previously mentioned intolerance of fish prey items to higher salinities.

Long-term Trends

Annual variability in count data has historically been high within South San Francisco Bay (De La Cruz et al. 2018), likely due to both real variability in populations (i.e., due to annual weather effects on fecundity and mortality) and stochastic differences in detection rate due to migration timing from year to year (e.g., whether birds happen to be present when on a pond when surveying). Year-to-year changes in abundance may therefore be misleading when drawing inferences about the health of local populations. Therefore, we used LOESS regression and three-year averages to assess long-term trends (De La Cruz et al. 2018, Tarjan et al. 2021).

For 6 out of 9 species/guild targets, the most recent three-year averages of waterbird counts from surveys that included all ponds (excluding March 2020–February 2021) exceeded their 2005–2007 SBSPRP baseline values (Table 15; SBSPRP 2007). Since most taxa have grown overall, this indicates long-term benefits of the project for waterbird populations within South San Francisco Bay. For most of the species/guilds that increased in abundance across all ponds, the increases are largely due to higher counts within the SBSPRP area. Eared grebes are the exception; counts have increased overall, but this is attributed to their use of salt production ponds rather than their use of SBSPRP sites. Eared grebe numbers may remain above target values in South San Francisco Bay if practices remain consistent at salt production ponds, but it should be noted that eared grebe abundance within the SBSPRP ponds in recent years has been approaching zero (Figures 13–15). However, recent trends show a decline in most guilds that warrant attention (Figures 50–52). Small shorebirds are the only guilds/species that currently have a flat trendline (slightly positive in fall and slightly negative in spring).

Two species/guilds have declined below trigger values defined in the Adaptive Management Plan (SBSPRP 2007): Bonaparte's gulls and phalaropes. In the previous year, Bonaparte's gull had declined by 84% relative to their baseline abundance, crossing the adaptive management plan's trigger threshold of >50% decline below the baseline in a single year. This winter, detections of Bonaparte's gull had increased from the previous year to an average of 763, but this still represents a decline of -40% and the best available running average two-year decline is -62% (winter season of 2020 was not surveyed due to COVID-19 restrictions). Interpolating 2020 values as the mean of 2021 and 2020 results in a three-year average decline of -57%. NEPA/CEQA significance thresholds require that a decline is due to restoration activities. Triggers for phalaropes, another migratory saline specialist guild, were also crossed, suggesting an underlying causative factor with respect to the current quality or quantity of migratory foraging habitat. Given this, we recommend entering into the Adaptive Management Plan process to consider data needs to determine the drivers of these two trends and, if it is determined to be an issue with current management practices within the SBSPRP area, develop habitat management guidelines to recover these taxa. Given the limited area of pond habitat that can be retained within the SBSPRP footprint, we recommend developing integrated habitat enhancement plans that can benefit both taxa to optimize conservation returns on investment in habitat management.

All three duck groups have also declined in recent years. Diving ducks and ruddy ducks initially greatly increased in abundance shortly after the beginning of the SBSPRP, and remain above their baseline abundances, but now show clear multi-year signs of a downward trend. Dabbling ducks increased markedly during the initial phase, but analyses suggest a long-term decline since this point, though with significant variability in raw annual counts (Figure 50). The total trend (black line) shows what appear to be three weak nadirs, with the current nadir the lowest one yet, which does indicate that this could be an actual decline. However, we recommended this be a lower priority for research and adaptive management because of the slow pace of this decline, remaining large size of the population, and the fact that the Adaptive Management Plan does not set trigger thresholds for this taxa (SBSPRP 2007).

Considerations for Future Study

We emphasize that this report serves as a data summary and coarse-scale assessment of waterbird and water quality monitoring efforts at South Bay ponds. In general, more advanced analyses are needed to tease apart complex temporal and spatial patterns operating at different scales within this dynamic system. A coupled analysis of both Cargill-managed ponds and SBSPRP was a first step that we incorporated into the long-term trend analysis. Recent trends point towards declines across multiple taxa, which are reversing previous gains. Most wildlife populations exhibit cyclical population trends, so this is not necessarily yet cause for alarm; monitoring nadir-to-nadir over longer time periods (i.e., are the low points getting lower) can reliably identify whether the taxa are truly declining (Coates et al. 2021). The strong synchrony among different taxa could point a shared common factor independent of local habitat, such as weather. Warnock et al. (2021) found strong effects of both restoration actions (positive effect) and annual weather (negative effect) on shorebird abundance, with lags of up to four years. Time-lagged impacts are commonly observed in population biology because influences on adult condition can take years to trickle down through fecundity to juvenile recruitment and eventual overall population size (Metzger 2009). Comparison of trends within the SBSPRP and nearby ponds to those elsewhere in California could elucidate whether this decline is in line with broader factors, or an issue with habitats within the SBSPRP area (Coates et al. 2021). The lack of inverse trends in the abundance of birds at SBSPRP sites and Cargill-managed sites likewise indicates that changes in numbers may be driven by factors operating on larger geographic scales (e.g., the scale of the Pacific Flyway; Murphy et al. 2007).

We suggest targeting any new research efforts first on those taxa that have been identified as crossing Adaptive Management Plan triggers (SBSPRP 2007): Bonaparte's gulls and phalaropes. Initial review and data re-analysis studies on phalaropes have shed light on the timing and severity of their decline, and helped more firmly established current population trends (LaBarbera et al. 2023, Burns and Van Schmidt 2023). It may be fruitful to do comparable review analyses on the current state of Bonaparte gull populations outside of the San Francisco Bay and available data sources for comparing populations in and outside of the SBSPRP area. Furthermore, new surveys across the Pacific Flyway (Carle et al. 2021) will soon make it possible to compare trends in our local targeted phalarope counts (Burns et al. 2023) to those at other staging sites. In combination with eBird data, this could provide the resolution needed to develop a model to test whether phalarope populations in South San Francisco Bay are tracking wider trends, or uniquely declining (i.e., following the methods of Coates et al. 2021). Once such a workflow is developed, it could then be incorporated into a monitoring system for the other taxa.

Ultimately, monitoring of declines is only useful if the drivers of the declines can be diagnosed and management can be altered to reverse those declines. While monitoring is crucial, better habitat information is also needed to understand how to manage ponds. Water level and quality parameters likely affected prey availability of foraging birds and contributed, at least in part, to observed guild distribution patterns (see Velasquez 1992, Warnock et al. 2002, Takekawa et al. 2006). Scullen et al. (2013) and De La Cruz (2018) found that in Cargill-managed ponds, water quality parameters had positive, negative, and no effects on guild abundances, depending on the guild and the water quality parameter. These studies could form the basis for whether changes in water quality over time are related to changes in population sizes within ponds (i.e., habitat selection), and to assess scenarios of alternative water quality management strategies or the impacts of climate change (i.e., warming temperatures and subsequently lower dissolve oxygen concentrations) on waterbirds. With more than a decade of waterbird and water quality monitoring data available, a model of how *changes* in bird site use are a function of *changes* in site characteristics and habitat availability is now possible. This model could then be used to predict bird use of sites under alternative future pond management and enhancement scenarios. This effort would provide a strong link between the bird monitoring work and habitat goals, and directly aid the SBSPRP in applying an adaptive management approach to restoration and management.

Lastly, we have two recommendations for improvements to field data collection. Given that invertebrate sampling for the SBSPRP was first conducted two decades ago (Brand et al. 2014), additional field sampling of prey items could now better test the connection between how changing water quality parameters may alter the quality of ponds as foraging habitat. This would be especially fruitful at ponds that are currently used by Bonaparte's gulls and phalaropes, and ponds that these taxa have disappeared from, to try and understand drivers of change. Because of the importance of water depth to many taxa, we also recommend that staff gauges be installed at all ponds in a standardized way so that water levels can be measured more consistently across the survey area and related to waterbird use.

Management Recommendations for the South Bay

We acknowledge the work of the South Bay Salt Pond Restoration's Pond Management Working Group in recommending and implementing changes at the pond systems since the initiation of the project. In order for the South Bay to retain its current bird numbers, we make the following recommendations for the South Bay Salt Pond Restoration Project's Project Management Team, Don Edwards San Francisco Bay National Wildlife Refuge, and Eden Landing Ecological Reserve to consider while managing ponds within the restoration project area:

1. Maintain the pond systems to have a variety of water quality parameter levels, thereby supporting guilds with different habitat requirements. Special consideration should be given to species of local concern within the SBSPRP management area, such as phalaropes and Bonaparte's gull. Consider managing ponds to support use by these species, or alter project targets for this guild to address declines at SBSPRP sites.

2. Provide islands or undisturbed levees for shorebird roosting habitat, and nesting habitat for other species. This is especially important during high tides.

3. Continue monitoring waterbird use of Cargill-managed and SBSPRP ponds as the project proceeds with its restoration activities. Models cannot work without data, and because of the complexities of the system (e.g., large-scale, long-term cyclical population dynamics, multiple changes happening at once), data at a sub-annual resolution is needed to adequately monitor to meet the goals of the Adaptive Management Plan (Tarjan et al. 2019).

4. Focus new field studies on understanding the local habitat needs of phalaropes and Bonaparte's gulls—particularly those habitat characteristics that can be altered by alternative management strategies—with the aim of identifying management solutions that co-benefit both species given the limited acreage of ponds that can be maintained.

5. Continue to maintain some flooded units during the winter months for diving duck populations (especially more pond dependent species, like Ruddy Duck).

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Tables

Table 1. Schedule of surveys for the reporting period. Survey numbers are generated consecutively, dating back to when SFBBO began surveying ponds in 2005. Current surveys comprise visits to 82 ponds at all complexes in a 6-week period and occur twice per season in fall, winter, and spring.

Survey	Season	Month Year	Start Date	End Date
144	fall	September 2022	2022-09-01	2022-10-11
145	fall	October 2022	2022-10-17	2022-11-28
146	winter	December 2022	2022-12-02	2023-01-13
147	winter	January 2023	2023-01-17	2023-02-17
148	spring	March 2023	2023-03-01	2023-04-13
149	spring	April 2023	2023-04-17	2023-05-24

Table 2. List of all ponds surveyed, their staff gauge location, and staff gauge status in 2023. Ponds marked with a '*' symbol are tidal.

Complex	Pond	Grid	Status	Notes
Alviso	A1	H1	GOOD	
	A10	A2	MISSING	Missing since 10/29/2014
	A11	E1	MISSING	Missing since 10/07/2019
	A12	C5	MISSING	Since at least Fall 2022 the corner is dug out by construction, inaccessible and likely gone
	A13	A2	GOOD	
	A14	A3	OK	Broken below 2.5
	A15	A2	GOOD	
	A16	E6	GOOD	
	A17	D1	GOOD	Tidal pond
	A19	NONE	MISSING	Missing since at least 2014. Tidal pond
	A22	NONE	MISSING	Missing since at least 2014
	A23	NONE	MISSING	Missing since at least 2014
	A2E	H7	MISSING	Missing since 10/03/2019
	A2W	A6	OK	Eroded below 0.5
	A3N	D1	GOOD	
	A3W	E9	GOOD	
	A5	B3	Staff gauge stick broken at bottom	
	A6S	NONE	MISSING	Missing since at least 2014. Tidal pond
	A7	A2	OK	Broken below 2.3
	A8	NONE	MISSING	Missing since at least 2014
	A8S	NONE	MISSING	Missing since at least 2014
	A8W	NONE	MISSING	Missing since at least 2014
	A9	D2	OK	Broken below 1.8
	AB1	A7	GOOD	
	AB2	J1	GOOD	Restored as of Fall 2022

Complex	Pond	Grid	Status	Notes
Coyote Hills	N1A	C1	GOOD	Old C8 was destroyed in storms, replaced with new C1 corner gauge
	N2A	C2	GOOD	
	N3A	C6	GOOD	
	N4	E5	GOOD	
	N4AA	I6	GOOD	
	N4AB	NONE	MISSING	
	N4B	NONE	MISSING	
	N5	A2	GOOD	
	N6	E2	GOOD	
	N7	A1	GOOD	
	N8	A2	GOOD	
	N9	A5	GOOD	
Dumbarton	N1	D8	GOOD	
	N2	C2	GOOD	
	N3	G1	GOOD	
	NPP1	C11	MISSING	Missing since 10/10/2019

Complex	Pond	Grid	Status	Notes
Eden Landing	E1	A1	GOOD	Replaced in 2019
	E10	F2	GOOD	
	E11	E3	GOOD	
	E12	D6	GOOD	
	E13	C2	GOOD	Two staff gauges, master is white plastic
	E14	B1	GOOD	
	E1C	E3	GOOD	
	E2	D1	GOOD	
	E2C	A2	GOOD	
	E3C	B2	GOOD	
	E4	B6	GOOD	
	E4C	NONE	MISSING	Missing since at least 2014
	E5	C6	GOOD	
	E5C	C4	GOOD	
	E6	D8	MISSING	SG removed during construction 2021
	E6A	A3	GOOD	
	E6B	A6	GOOD	
	E6C	A4	GOOD	
	E7	B5	MISSING	Missing as of 12/2020; replacement pending -> still missing 11/2022
	E8	I6	GOOD	
	E8AE	NONE	MISSING	Tidal pond
	E8AW	NONE	MISSING	Tidal pond
	E8XN	D3	OK	Can read up to 8ft
	E8XS	D3	OK	Can read up to 8ft, algae below 6ft, Tidal pond
	E9	A4	GOOD	Tidal pond

Complex	Pond	Grid	Status	Notes
Mowry	M1	H10	GOOD	
	M2	G10	GOOD	
	M3	B6	OK	Top number unreadable
	M4	C13	GOOD	
	M5	A3	GOOD	
	M6	B5	GOOD	
Ravenswood	R1	F8	GOOD	Consistently dry
	R2	D4	GOOD	
	R3	A6	MISSING	Missing since at least 2021
	R4	F1	MISSING	Removed fall 2019 due to construction
	R5	A1	MISSING	Missing since 2020
	R5S	NONE	MISSING	Missing since at least 2014
	RSF2U1	D6	GOOD	
	RSF2U2	E3	GOOD	
	RSF2U3	E3	GOOD	
	RSF2U4	E6	GOOD	

Table 3. Waterbird species richness, abundance (total sightings for all species combined), and acreage by pond complex and individual pond, South San Francisco Bay, California; September 2022 - May 2023.

Complex	Pond	Species Richness	Total Sightings	% of Total Sightings	% of Total Acreage	Most Common Guild
Alviso	A1	34	15767	1.27	1.38	DIVER
	A10	42	6024	0.48	1.26	DIVER
	A11	37	10714	0.86	1.32	DIVER
	A12	13	5354	0.43	1.55	GULL
	A13	24	10866	0.87	1.35	SMSHORE
	A14	41	34198	2.74	1.71	DIVER
	A15	25	14069	1.13	1.27	SMSHORE
	A16	53	35737	2.87	1.22	DABBLER
	A17	36	8598	0.69	0.66	DABBLER
	A19	16	7862	0.63	1.32	DABBLER
	A22	27	7802	0.63	1.35	SMSHORE
	A23	21	5027	0.40	2.25	GULL
	A2E	36	26415	2.12	1.60	DABBLER
	A2W	40	15720	1.26	2.16	DIVER
	A3N	30	10897	0.87	0.83	SMSHORE
	A3W	44	32373	2.60	2.82	DIVER
	A5	45	25064	2.01	3.17	DIVER
	A6S	23	2682	0.22	1.38	MEDSHORE
	A7	43	11483	0.92	1.33	DIVER
	A8	36	17323	1.39	2.04	DIVER
	A8S	36	5935	0.48	0.84	DIVER
	A8W	32	1399	0.11	0.08	GULL
	A9	48	92117	7.39	1.83	SMSHORE
	AB1	46	18994	1.52	0.76	SMSHORE
	AB2	45	25898	2.08	0.90	SMSHORE
	Subtotal	**70**	**448318**	**35.98**	**36.37**	**DIVER**
Coyote Hills	N1A	33	2440	0.20	0.83	DIVER
	N2A	30	7151	0.57	0.84	DIVER
	N3A	39	19639	1.58	2.07	DIVER
	N4	30	6040	0.48	1.68	MEDSHORE
	N4AA	45	10797	0.87	1.49	DABBLER

Complex	Pond	Species Richness	Total Sightings	% of Total Sightings	% of Total Acreage	Most Common Guild
	N4AB	34	15493	1.24	1.17	DIVER
	N4B	20	2151	0.17	0.32	GULL
	N5	17	790	0.06	0.95	GULL
	N6	26	7528	0.60	0.46	GULL
	N7	25	5131	0.41	1.88	GULL
	N8	26	1718	0.14	0.56	GULL
	N9	34	4471	0.36	0.67	SMSHORE
	Subtotal	**61**	**83349**	**6.69**	**12.91**	**DIVER**
Dumbarton	N1	25	11595	0.93	1.70	DIVER
	N2	23	4588	0.37	0.96	DABBLER
	N3	33	17450	1.40	2.72	SMSHORE
	NPP1	23	25450	2.04	0.95	SMSHORE
	Subtotal	**40**	**59083**	**4.74**	**6.32**	**DIVER**
Eden Landing	E1	33	6945	0.56	1.46	DIVER
	E10	38	7505	0.60	1.06	MEDSHORE
	E11	30	12456	1.00	0.62	MEDSHORE
	E12	41	19460	1.56	0.53	SMSHORE
	E13	33	16547	1.33	0.71	SMSHORE
	E14	20	12424	1.00	0.82	SMSHORE
	E1C	21	6646	0.53	0.32	SMSHORE
	E2	39	17775	1.43	3.37	DIVER
	E2C	26	2651	0.21	0.14	SMSHORE
	CP3C	33	14558	1.17	0.82	SMSHORE
	E4	35	32381	2.60	0.96	SMSHORE
	E4C	25	23113	1.85	0.87	SMSHORE
	E5	29	4868	0.39	0.82	DABBLER
	E5C	17	5007	0.40	0.47	SMSHORE
	E6	29	9128	0.73	0.96	SMSHORE
	E6A	46	32144	2.58	1.58	SMSHORE
	E6B	32	16820	1.35	1.40	SMSHORE
	E6C	17	926	0.07	0.41	SMSHORE
	E7	37	12235	0.98	1.07	DIVER
	E8	32	14931	1.20	0.93	SMSHORE

Complex	Pond	Species Richness	Total Sightings	% of Total Sightings	% of Total Acreage	Most Common Guild
	E8AE	17	4220	0.34	0.65	SMSHORE
	E8AW	19	8416	0.68	0.60	SMSHORE
	E8XN	14	815	0.07	0.05	DIVER
	E8XS	13	472	0.04	0.16	SMSHORE
	E9	33	43998	3.53	1.87	SMSHORE
	Subtotal	**67**	**326441**	**26.20**	**22.64**	**DIVER**
Mowry	M1	30	25700	2.06	2.45	SMSHORE
	M2	35	30677	2.46	2.39	SMSHORE
	M3	24	14534	1.17	2.71	EAREDGR
	M4	20	27603	2.22	2.64	EAREDGR
	M5	19	17815	1.43	2.05	EAREDGR
	M6	16	11628	0.93	2.20	EAREDGR
	Subtotal	**44**	**127957**	**10.27**	**14.44**	**DIVER**
Ravenswood	R1	44	131345	10.54	2.22	SMSHORE
	R2	21	2020	0.16	0.70	MEDSHORE
	R3	21	6091	0.49	1.40	SMSHORE
	R4	28	16733	1.34	1.47	SMSHORE
	R5	15	425	0.03	0.15	SMSHORE
	R5S	17	1662	0.13	0.15	SMSHORE
	RSF2U1	35	8695	0.70	0.28	MEDSHORE
	RSF2U2	36	24513	1.97	0.41	MEDSHORE
	RSF2U3	22	6153	0.49	0.44	SMSHORE
	RSF2U4	32	3287	0.26	0.08	SMSHORE
Ravenswood	**Subtotal**	**57**	**200924**	**16.12**	**7.31**	**DIVER**
Survey Area	**Total**	**83**	**1246072**	**100.00**	**100.00**	**DIVER**

Table 4. Percentage of total birds foraging, roosting, and using islands, levees, or manmade structures (e.g., blinds, fence posts) in each pond, South San Francisco Bay, California; September 2022 - May 2023. N is the total number of bird sightings during the study period. Pond CP3C is in the Eden Landing area but owned by Cargill.

Complex	Pond	% Foraging	% Roosting	% Island	% Levee	% Manmade	N
Alviso	A1	16.1	82.5	0.0	0.2	1.2	15767
Alviso	A10	18.8	74.4	0.1	6.8	0.0	6024
Alviso	A11	10.1	79.6	0.0	10.3	0.0	10714
Alviso	A12	0.8	73.0	25.4	0.8	0.0	5354
Alviso	A13	58.2	41.3	0.2	0.2	0.0	10866
Alviso	A14	14.7	81.0	0.0	4.3	0.0	34198
Alviso	A15	42.9	55.8	0.5	0.7	0.0	14069
Alviso	A16	21.2	70.0	8.1	0.0	0.7	35737
Alviso	A17	50.2	49.7	0.0	0.0	0.0	8598
Alviso	A19	27.0	72.9	0.0	0.0	0.0	7862
Alviso	A22	33.9	59.1	0.2	6.8	0.0	7802
Alviso	A23	32.8	33.6	0.0	33.5	0.0	5027
Alviso	A2E	18.9	73.2	0.1	7.5	0.4	26415
Alviso	A2W	7.5	85.7	0.0	0.3	6.4	15720
Alviso	A3N	31.9	67.3	0.0	0.2	0.6	10897
Alviso	A3W	18.6	77.1	0.0	1.6	2.6	32373
Alviso	A5	16.3	55.3	0.0	28.4	0.0	25064
Alviso	A6S	48.4	50.3	0.4	0.8	0.1	2682
Alviso	A7	26.8	24.4	3.4	45.3	0.1	11483
Alviso	A8	7.1	84.9	0.0	7.9	0.1	17323
Alviso	A8S	8.0	65.3	0.0	26.7	0.0	5935
Alviso	A8W	10.9	20.3	0.0	68.8	0.0	1399
Alviso	A9	37.7	62.2	0.0	0.0	0.0	92117
Alviso	AB1	51.0	47.0	1.2	0.3	0.5	18994
Alviso	AB2	39.1	39.5	5.4	15.6	0.4	25898
Coyote Hills	N1A	14.4	56.2	0.0	29.0	0.4	2440
Coyote Hills	N2A	6.8	56.5	0.0	36.7	0.0	7151
Coyote Hills	N3A	12.8	57.2	0.0	29.8	0.2	19639
Coyote Hills	N4	10.1	66.0	20.1	3.6	0.2	6040
Coyote Hills	N4AA	51.3	44.1	0.5	2.5	1.7	10797
Coyote Hills	N4AB	20.5	58.0	0.1	21.4	0.1	15493
Coyote Hills	N4B	73.8	25.4	0.0	0.6	0.2	2151

Complex	Pond	% Foraging	% Roosting	% Island	% Levee	% Manmade	N
Coyote Hills	N5	15.9	32.9	0.0	50.8	0.4	790
Coyote Hills	N6	15.8	21.2	0.0	62.9	0.0	7528
Coyote Hills	N7	4.4	34.7	0.0	60.7	0.2	5131
Coyote Hills	N8	7.5	15.8	0.0	76.7	0.0	1718
Coyote Hills	N9	22.3	23.6	0.9	53.1	0.2	4471
Dumbarton	N1	41.8	49.5	4.7	1.3	2.8	11595
Dumbarton	N2	54.8	37.2	2.9	5.0	0.0	4588
Dumbarton	N3	18.4	29.7	27.4	24.4	0.1	17450
Dumbarton	NPP1	34.3	61.4	3.8	0.6	0.0	25450
Eden Landing	E1	32.2	58.0	4.5	4.7	0.5	6945
Eden Landing	E10	36.5	62.1	0.3	0.1	1.0	7505
Eden Landing	E11	40.3	59.2	0.0	0.0	0.4	12456
Eden Landing	E12	21.5	62.3	8.6	5.2	2.4	19460
Eden Landing	E13	32.2	53.1	0.7	11.8	2.2	16547
Eden Landing	E14	53.9	46.1	0.0	0.0	0.0	12424
Eden Landing	E1C	50.5	48.8	0.6	0.1	0.1	6646
Eden Landing	E2	22.4	72.2	4.5	0.6	0.3	17775
Eden Landing	E2C	65.0	35.0	0.0	0.1	0.0	2651
Eden Landing	CP3C	38.3	59.7	0.1	0.0	2.0	14558
Eden Landing	E4	29.1	70.5	0.0	0.1	0.4	32381
Eden Landing	E4C	24.6	69.4	0.4	0.0	5.6	23113
Eden Landing	E5	72.3	22.8	0.0	3.2	1.7	4868
Eden Landing	E5C	48.6	50.9	0.0	0.3	0.2	5007
Eden Landing	E6	36.1	63.1	0.0	0.1	0.7	9128
Eden Landing	E6A	46.0	53.9	0.0	0.0	0.2	32144
Eden Landing	E6B	21.0	78.9	0.0	0.0	0.0	16820
Eden Landing	E6C	45.7	34.1	0.0	19.3	0.9	926
Eden Landing	E7	7.8	82.3	0.0	0.2	9.6	12235
Eden Landing	E8	19.7	76.7	0.0	0.0	3.5	14931
Eden Landing	E8AE	55.2	44.8	0.0	0.0	0.0	4220
Eden Landing	E8AW	19.7	80.3	0.0	0.0	0.0	8416
Eden Landing	E8XN	3.8	96.1	0.0	0.1	0.0	815
Eden Landing	E8XS	65.7	34.3	0.0	0.0	0.0	472
Eden Landing	E9	31.7	68.3	0.0	0.0	0.0	43998
Mowry	M1	1.5	8.4	0.0	90.1	0.0	25700
Mowry	M2	2.0	4.8	15.9	77.2	0.0	30677

Complex	Pond	% Foraging	% Roosting	% Island	% Levee	% Manmade	N
Mowry	M3	35.6	41.8	10.0	12.4	0.1	14534
Mowry	M4	19.6	68.8	0.5	11.1	0.0	27603
Mowry	M5	33.1	56.4	0.6	9.9	0.1	17815
Mowry	M6	48.5	44.7	0.1	5.0	1.6	11628
Ravenswood	R1	38.2	61.6	0.0	0.1	0.0	131345
Ravenswood	R2	82.0	17.6	0.0	0.3	0.0	2020
Ravenswood	R3	16.7	83.2	0.0	0.1	0.0	6091
Ravenswood	R4	31.9	56.9	11.2	0.1	0.0	16733
Ravenswood	R5	36.7	63.1	0.0	0.2	0.0	425
Ravenswood	R5S	9.5	90.5	0.0	0.0	0.0	1662
Ravenswood	RSF2U1	8.6	51.1	27.1	11.9	1.2	8695
Ravenswood	RSF2U2	6.9	19.5	69.8	3.9	0.0	24513
Ravenswood	RSF2U3	39.1	60.8	0.0	0.1	0.0	6153
Ravenswood	RSF2U4	45.5	52.3	0.0	2.2	0.0	3287

Table 5. Percentage of dabbling ducks foraging, roosting, and using islands, levees, or manmade structures (e.g., blinds, fence posts) in each pond, South San Francisco Bay, California; September 2022 - May 2023. N is the total number of bird sightings during the study period. Only ponds with one or more sightings are shown. Pond CP3C is in the Eden Landing area but owned by Cargill.

Complex	Pond	% Foraging	% Roosting	% Island	% Levee	% Manmade	N
Alviso	A1	46.0	54.0	0.0	0.0	0.0	3315
Alviso	A10	73.0	25.7	0.0	1.3	0.0	152
Alviso	A11	3.4	44.8	0.0	51.7	0.0	58
Alviso	A13	47.6	52.4	0.0	0.0	0.0	21
Alviso	A14	22.0	77.6	0.0	0.3	0.0	14782
Alviso	A15	0.0	100.0	0.0	0.0	0.0	3
Alviso	A16	26.6	68.2	5.1	0.0	0.1	21133
Alviso	A17	45.3	54.7	0.0	0.0	0.0	4207
Alviso	A19	22.8	77.2	0.0	0.0	0.0	4934
Alviso	A22	18.6	81.2	0.2	0.0	0.0	981
Alviso	A23	0.0	20.0	0.0	80.0	0.0	5
Alviso	A2E	24.8	75.1	0.0	0.2	0.0	12624
Alviso	A2W	23.8	75.0	0.0	1.1	0.1	1531
Alviso	A3N	42.4	53.3	0.0	4.3	0.0	349
Alviso	A3W	27.4	72.5	0.0	0.0	0.0	6383
Alviso	A5	15.1	65.0	0.0	19.8	0.0	2323
Alviso	A6S	51.4	47.6	1.0	0.0	0.0	969
Alviso	A7	17.6	19.4	2.0	61.0	0.0	756
Alviso	A8	15.3	83.4	0.0	0.9	0.3	634
Alviso	A8S	41.7	50.9	0.0	7.5	0.0	348
Alviso	A8W	25.0	65.0	0.0	10.0	0.0	80
Alviso	A9	25.4	74.6	0.0	0.0	0.0	12737
Alviso	AB1	27.0	70.8	1.3	0.3	0.6	6124
Alviso	AB2	53.5	36.0	9.6	0.8	0.0	3427
Coyote Hills	N1A	8.2	91.8	0.0	0.0	0.0	61
Coyote Hills	N2A	28.1	71.9	0.0	0.0	0.0	32
Coyote Hills	N3A	18.3	76.5	0.0	5.3	0.0	4031
Coyote Hills	N4	25.0	75.0	0.0	0.0	0.0	8
Coyote Hills	N4AA	53.3	46.2	0.5	0.0	0.0	5729
Coyote Hills	N4AB	55.9	43.4	0.2	0.5	0.0	3904
Coyote Hills	N4B	61.6	38.4	0.0	0.0	0.0	648
Coyote Hills	N5	0.0	100.0	0.0	0.0	0.0	41

Complex	Pond	% Foraging	% Roosting	% Island	% Levee	% Manmade	N
Coyote Hills	N6	24.4	74.1	0.0	1.5	0.0	205
Coyote Hills	N7	72.4	27.6	0.0	0.0	0.0	29
Coyote Hills	N8	65.3	30.6	0.0	4.1	0.0	49
Coyote Hills	N9	3.6	53.9	0.0	42.5	0.0	475
Dumbarton	N1	55.9	38.1	0.0	6.0	0.0	2083
Dumbarton	N2	67.1	25.6	0.0	7.2	0.0	2818
Dumbarton	N3	24.6	66.4	4.0	4.9	0.0	4050
Dumbarton	NPP1	80.3	19.7	0.0	0.0	0.0	178
Eden Landing	E1	53.5	46.5	0.0	0.0	0.0	710
Eden Landing	E10	64.4	35.6	0.0	0.0	0.0	539
Eden Landing	E11	67.2	32.8	0.0	0.0	0.0	1743
Eden Landing	E12	58.4	30.1	4.5	7.0	0.0	2263
Eden Landing	E13	39.6	54.8	3.2	2.3	0.1	1258
Eden Landing	E14	41.7	58.3	0.0	0.0	0.0	12
Eden Landing	E1C	49.7	46.3	4.0	0.0	0.0	925
Eden Landing	E2	35.5	63.6	0.9	0.0	0.0	2397
Eden Landing	E2C	40.1	59.9	0.0	0.0	0.0	543
Eden Landing	CP3C	20.5	79.4	0.1	0.0	0.0	4611
Eden Landing	E4	29.6	70.3	0.0	0.0	0.0	10136
Eden Landing	E4C	77.0	23.0	0.0	0.0	0.0	1706
Eden Landing	E5	53.8	38.2	0.0	8.1	0.0	1328
Eden Landing	E5C	26.0	74.0	0.0	0.0	0.0	1230
Eden Landing	E6	3.9	95.7	0.0	0.3	0.0	2332
Eden Landing	E6A	38.8	61.2	0.0	0.0	0.0	5136
Eden Landing	E6B	45.7	54.3	0.0	0.0	0.0	704
Eden Landing	E6C	27.1	72.9	0.0	0.0	0.0	229
Eden Landing	E7	47.4	52.4	0.0	0.0	0.1	698
Eden Landing	E8	28.5	71.5	0.0	0.0	0.0	1994
Eden Landing	E8AE	60.2	39.8	0.0	0.0	0.0	309
Eden Landing	E8AW	43.3	56.7	0.0	0.0	0.0	60
Eden Landing	E8XN	0.0	100.0	0.0	0.0	0.0	8
Eden Landing	E8XS	13.4	86.6	0.0	0.0	0.0	112
Eden Landing	E9	45.7	54.3	0.0	0.0	0.0	3957
Mowry	M1	0.6	42.2	0.0	57.2	0.0	486
Mowry	M2	1.4	66.9	26.8	4.9	0.0	142
Mowry	M3	71.3	7.9	0.0	20.8	0.0	1015

Complex	Pond	% Foraging	% Roosting	% Island	% Levee	% Manmade	N
Mowry	M4	23.2	56.9	0.0	19.9	0.0	3133
Mowry	M5	24.1	69.2	1.2	5.4	0.1	4436
Mowry	M6	84.7	12.8	0.0	2.5	0.0	1008
Ravenswood	R1	9.7	90.3	0.0	0.0	0.0	247
Ravenswood	R2	76.5	23.5	0.0	0.0	0.0	34
Ravenswood	R3	0.0	100.0	0.0	0.0	0.0	25
Ravenswood	R4	11.8	88.2	0.0	0.0	0.0	1267
Ravenswood	R5	2.6	97.4	0.0	0.0	0.0	78
Ravenswood	R5S	0.0	100.0	0.0	0.0	0.0	244
Ravenswood	RSF2U1	43.9	16.7	30.8	8.6	0.1	923
Ravenswood	RSF2U2	16.7	43.3	38.2	1.7	0.0	7964
Ravenswood	RSF2U3	50.0	50.0	0.0	0.0	0.0	6
Ravenswood	RSF2U4	51.0	22.0	0.0	27.1	0.0	255

Table 6. Percentage of diving ducks foraging, roosting, and using islands, levees, or manmade structures (e.g., blinds, fence posts) in each pond, South San Francisco Bay, California; September 2022 - May 2023. N is the total number of bird sightings during the study period. Only ponds with one or more sightings are shown. Pond CP3C is in the Eden Landing area but owned by Cargill.

Complex	Pond	% Foraging	% Roosting	% Island	% Levee	% Manmade	N
Alviso	A1	7.8	92.2	0.0	0.0	0.0	11805
Alviso	A10	12.9	87.1	0.0	0.0	0.0	4835
Alviso	A11	7.0	92.9	0.0	0.0	0.0	8755
Alviso	A13	36.5	63.5	0.0	0.0	0.0	521
Alviso	A14	6.2	93.8	0.0	0.0	0.0	16614
Alviso	A15	97.5	2.5	0.0	0.0	0.0	80
Alviso	A16	7.3	92.6	0.0	0.0	0.0	6899
Alviso	A17	5.7	94.3	0.0	0.0	0.0	495
Alviso	A19	0.0	100.0	0.0	0.0	0.0	16
Alviso	A22	56.4	43.6	0.0	0.0	0.0	117
Alviso	A23	33.3	66.7	0.0	0.0	0.0	21
Alviso	A2E	11.8	88.2	0.0	0.0	0.0	10471
Alviso	A2W	4.5	95.5	0.0	0.0	0.0	12492
Alviso	A3N	12.6	87.4	0.0	0.0	0.0	167
Alviso	A3W	11.4	88.6	0.0	0.0	0.0	16865
Alviso	A5	21.4	78.6	0.0	0.0	0.0	14893
Alviso	A6S	14.7	85.3	0.0	0.0	0.0	68
Alviso	A7	49.7	50.1	0.0	0.2	0.0	4653
Alviso	A8	6.5	93.4	0.0	0.0	0.0	14908
Alviso	A8S	6.3	93.7	0.0	0.0	0.0	3202
Alviso	A8W	29.7	70.3	0.0	0.0	0.0	172
Alviso	A9	3.0	97.0	0.0	0.0	0.0	3965
Alviso	AB1	20.1	79.8	0.0	0.2	0.0	1146
Alviso	AB2	5.1	94.9	0.0	0.0	0.0	4781
Coyote Hills	N1A	11.9	88.1	0.0	0.0	0.0	1428
Coyote Hills	N2A	9.5	90.5	0.0	0.0	0.0	3941
Coyote Hills	N3A	9.2	89.5	0.0	1.3	0.0	8590
Coyote Hills	N4	72.8	27.2	0.0	0.0	0.0	81
Coyote Hills	N4AA	39.5	60.5	0.0	0.0	0.0	2988
Coyote Hills	N4AB	10.9	89.1	0.0	0.0	0.0	7665

Complex	Pond	% Foraging	% Roosting	% Island	% Levee	% Manmade	N
Coyote Hills	N4B	3.9	96.1	0.0	0.0	0.0	283
Coyote Hills	N5	31.1	67.8	0.0	0.0	1.1	90
Coyote Hills	N6	11.9	88.1	0.0	0.0	0.0	1173
Coyote Hills	N7	3.7	96.3	0.0	0.0	0.0	1743
Coyote Hills	N8	1.8	97.6	0.0	0.6	0.0	169
Coyote Hills	N9	16.5	83.5	0.0	0.0	0.0	333
Dumbarton	N1	46.7	53.3	0.0	0.0	0.0	5080
Dumbarton	N2	36.6	63.4	0.0	0.0	0.0	784
Dumbarton	N3	82.8	17.1	0.1	0.0	0.0	1415
Dumbarton	NPP1	64.3	35.7	0.0	0.0	0.0	1040
Eden Landing	E1	22.2	77.8	0.0	0.0	0.0	4496
Eden Landing	E10	5.3	94.6	0.0	0.0	0.0	2305
Eden Landing	E11	4.8	95.2	0.0	0.0	0.0	786
Eden Landing	E12	31.2	68.5	0.0	0.3	0.0	615
Eden Landing	E13	13.8	86.2	0.0	0.0	0.0	195
Eden Landing	E14	0.0	100.0	0.0	0.0	0.0	1
Eden Landing	E1C	75.0	25.0	0.0	0.0	0.0	20
Eden Landing	E2	8.6	91.4	0.0	0.0	0.0	12065
Eden Landing	E2C	20.0	80.0	0.0	0.0	0.0	5
Eden Landing	CP3C	10.2	89.8	0.0	0.0	0.0	927
Eden Landing	E4	8.2	91.8	0.0	0.0	0.0	461
Eden Landing	E4C	30.8	69.2	0.0	0.0	0.0	169
Eden Landing	E5	71.7	28.3	0.0	0.0	0.0	1017
Eden Landing	E5C	76.1	23.9	0.0	0.0	0.0	46
Eden Landing	E6	31.4	68.6	0.0	0.0	0.0	722
Eden Landing	E6A	7.1	92.9	0.0	0.0	0.0	7342
Eden Landing	E6B	9.7	90.3	0.0	0.0	0.0	648
Eden Landing	E6C	80.9	19.1	0.0	0.0	0.0	157
Eden Landing	E7	2.5	97.5	0.0	0.0	0.0	9480
Eden Landing	E8	10.1	89.9	0.0	0.0	0.0	1143
Eden Landing	E8AW	0.0	100.0	0.0	0.0	0.0	47
Eden Landing	E8XN	1.9	98.1	0.0	0.0	0.0	787
Eden Landing	E9	11.3	88.7	0.0	0.0	0.0	416

Complex	**Pond**	**% Foraging**	**% Roosting**	**% Island**	**% Levee**	**% Manmade**	**N**
Mowry	M1	3.5	96.5	0.0	0.0	0.0	1736
Mowry	M2	13.6	86.4	0.0	0.0	0.0	391
Mowry	M3	27.3	72.7	0.0	0.0	0.0	22
Mowry	M4	23.8	76.2	0.0	0.0	0.0	172
Mowry	M5	49.3	50.7	0.0	0.0	0.0	623
Mowry	M6	61.5	38.5	0.0	0.0	0.0	26
Ravenswood	R1	8.3	91.7	0.0	0.0	0.0	1599
Ravenswood	R2	76.3	23.7	0.0	0.0	0.0	515
Ravenswood	R3	7.3	92.7	0.0	0.0	0.0	137
Ravenswood	R4	42.0	58.0	0.0	0.0	0.0	891
Ravenswood	R5S	100.0	0.0	0.0	0.0	0.0	1
Ravenswood	RSF2U1	32.5	66.7	0.0	0.8	0.0	631
Ravenswood	RSF2U2	18.6	81.4	0.0	0.0	0.0	829
Ravenswood	RSF2U3	96.3	3.7	0.0	0.0	0.0	135
Ravenswood	RSF2U4	4.2	95.8	0.0	0.0	0.0	1275

Table 7. Percentage of eared grebes foraging, roosting, and using islands, levees, or manmade structures (e.g., blinds, fence posts) in each pond, South San Francisco Bay, California; September 2022 - May 2023. N is the total number of bird sightings during the study period. Only ponds with one or more sightings are shown. Pond CP3C is in the Eden Landing area but owned by Cargill.

Complex	Pond	% Foraging	% Roosting	% Island	% Levee	% Manmade	N
Alviso	A1	41.1	58.9	0	0	0	73
Alviso	A10	81.5	18.5	0	0	0	27
Alviso	A11	83.7	16.3	0	0	0	135
Alviso	A13	26.9	73.1	0	0	0	78
Alviso	A14	48.3	51.7	0	0	0	271
Alviso	A15	26.7	73.3	0	0	0	15
Alviso	A16	75.4	24.6	0	0	0	57
Alviso	A17	100.0	0.0	0	0	0	3
Alviso	A22	0.0	100.0	0	0	0	1
Alviso	A2E	78.5	21.5	0	0	0	65
Alviso	A2W	24.7	75.3	0	0	0	73
Alviso	A3N	0.0	100.0	0	0	0	3
Alviso	A3W	43.5	56.5	0	0	0	124
Alviso	A5	69.7	30.3	0	0	0	175
Alviso	A7	60.6	39.4	0	0	0	33
Alviso	A8	40.0	60.0	0	0	0	30
Alviso	A8S	18.7	81.3	0	0	0	230
Alviso	A8W	40.6	59.4	0	0	0	32
Alviso	AB1	0.0	100.0	0	0	0	2
Alviso	AB2	73.7	26.3	0	0	0	19
Coyote Hills	N1A	50.0	50.0	0	0	0	2
Coyote Hills	N2A	31.2	68.8	0	0	0	16
Coyote Hills	N3A	85.7	14.3	0	0	0	7
Coyote Hills	N4	71.6	28.4	0	0	0	67
Coyote Hills	N4AA	0.0	100.0	0	0	0	3
Coyote Hills	N4AB	86.7	13.3	0	0	0	30
Coyote Hills	N6	100.0	0.0	0	0	0	1
Coyote Hills	N7	64.3	35.7	0	0	0	14
Coyote Hills	N8	0.0	100.0	0	0	0	2
Dumbarton	N1	32.0	68.0	0	0	0	2142

Dumbarton	N2	10.3	89.7	0	0	0	213
Dumbarton	N3	33.1	66.9	0	0	0	955
Dumbarton	NPP1	63.4	36.6	0	0	0	410
Eden Landing	E1	90.0	10.0	0	0	0	10
Eden Landing	E10	25.0	75.0	0	0	0	8
Eden Landing	E12	66.7	33.3	0	0	0	3
Eden Landing	E13	100.0	0.0	0	0	0	2
Eden Landing	E2	100.0	0.0	0	0	0	10
Eden Landing	CP3C	100.0	0.0	0	0	0	10
Eden Landing	E4C	100.0	0.0	0	0	0	2
Eden Landing	E5	57.1	42.9	0	0	0	7
Eden Landing	E6	70.6	29.4	0	0	0	160
Eden Landing	E6A	59.2	40.8	0	0	0	49
Eden Landing	E6B	57.6	42.4	0	0	0	33
Eden Landing	E6C	0.0	100.0	0	0	0	1
Eden Landing	E7	40.0	60.0	0	0	0	10
Eden Landing	E8	57.1	42.9	0	0	0	7
Mowry	M1	10.1	89.9	0	0	0	148
Mowry	M2	7.3	92.7	0	0	0	451
Mowry	M3	36.5	63.5	0	0	0	8771
Mowry	M4	13.9	86.1	0	0	0	19214
Mowry	M5	27.7	72.3	0	0	0	9145
Mowry	M6	24.6	75.4	0	0	0	6104
Ravenswood	R1	53.8	46.2	0	0	0	13
Ravenswood	R2	0.0	100.0	0	0	0	4
Ravenswood	R3	33.3	66.7	0	0	0	6
Ravenswood	R4	3.7	96.3	0	0	0	27
Ravenswood	RSF2U1	100.0	0.0	0	0	0	1
Ravenswood	RSF2U2	0.0	100.0	0	0	0	1
Ravenswood	RSF2U4	75.0	25.0	0	0	0	4

Table 8. Percentage of fisheaters foraging, roosting, and using islands, levees, or manmade structures (e.g., blinds, fence posts) in each pond, South San Francisco Bay, California; September 2022 - May 2023. N is the total number of bird sightings during the study period. Only ponds with one or more sightings are shown. Pond CP3C is in the Eden Landing area but owned by Cargill.

Complex	Pond	% Foraging	% Roosting	% Island	% Levee	% Manmade	N
Alviso	A1	10.6	50.9	0.0	0.3	38.1	320
Alviso	A10	46.3	33.9	0.0	19.8	0.0	449
Alviso	A11	20.3	21.3	0.0	58.4	0.0	1337
Alviso	A13	0.0	0.0	0.0	100.0	0.0	4
Alviso	A14	15.0	29.1	0.0	55.9	0.0	994
Alviso	A16	18.0	13.3	61.5	0.0	7.2	1270
Alviso	A17	3.8	96.2	0.0	0.0	0.0	26
Alviso	A19	0.0	100.0	0.0	0.0	0.0	1
Alviso	A2E	44.1	6.5	0.0	47.7	1.7	417
Alviso	A2W	12.0	21.1	0.0	0.4	66.5	1079
Alviso	A3N	100.0	0.0	0.0	0.0	0.0	3
Alviso	A3W	23.6	21.7	0.1	1.1	53.6	1019
Alviso	A5	12.6	13.5	0.0	73.8	0.1	1288
Alviso	A6S	0.0	100.0	0.0	0.0	0.0	1
Alviso	A7	8.8	3.9	3.0	84.3	0.0	1297
Alviso	A8	12.7	33.9	0.0	48.7	4.8	189
Alviso	A8S	24.2	55.0	0.0	20.8	0.0	149
Alviso	A8W	17.7	31.6	0.0	50.6	0.0	79
Alviso	A9	26.4	65.5	0.0	8.2	0.0	110
Alviso	AB1	37.7	11.6	2.9	20.3	27.5	138
Alviso	AB2	4.7	15.9	65.1	4.3	10.0	301
Coyote Hills	N1A	22.9	9.9	0.0	65.5	1.8	385
Coyote Hills	N2A	12.2	15.1	0.0	72.7	0.0	509
Coyote Hills	N3A	4.8	3.4	0.0	91.0	0.8	1213
Coyote Hills	N4	20.6	61.8	0.0	0.0	17.6	34
Coyote Hills	N4AA	77.9	6.9	0.0	14.7	0.6	714
Coyote Hills	N4AB	10.6	8.5	0.0	79.6	1.2	668
Coyote Hills	N4B	97.6	0.0	0.0	2.4	0.0	164
Coyote Hills	N5	4.6	26.7	0.0	68.7	0.0	131
Coyote Hills	N6	50.0	40.6	0.0	6.2	3.1	32

Coyote Hills	N7	20.6	18.8	0.0	57.7	2.9	272
Coyote Hills	N8	16.4	19.6	0.0	64.0	0.0	189
Coyote Hills	N9	13.2	8.8	1.2	75.0	1.8	400
Dumbarton	N1	0.0	0.0	0.0	0.0	100.0	3
Dumbarton	N2	0.0	100.0	0.0	0.0	0.0	5
Dumbarton	N3	30.8	7.7	0.0	0.0	61.5	13
Eden Landing	E1	83.7	11.8	2.6	0.4	1.4	761
Eden Landing	E10	47.4	5.3	36.8	0.0	10.5	19
Eden Landing	E11	0.0	0.0	0.0	0.0	100.0	1
Eden Landing	E12	2.5	82.5	0.0	15.0	0.0	40
Eden Landing	E13	10.5	0.0	0.0	89.5	0.0	19
Eden Landing	E2	19.8	35.9	7.6	32.5	4.2	237
Eden Landing	CP3C	66.7	33.3	0.0	0.0	0.0	3
Eden Landing	E4	2.7	97.3	0.0	0.0	0.0	37
Eden Landing	E5	0.0	33.8	0.0	66.2	0.0	65
Eden Landing	E6	0.0	0.0	0.0	0.0	100.0	2
Eden Landing	E6A	66.7	28.3	0.0	0.0	5.0	60
Eden Landing	E6B	0.0	100.0	0.0	0.0	0.0	1
Eden Landing	E6C	0.0	0.0	0.0	100.0	0.0	1
Eden Landing	E7	9.4	8.5	0.0	2.3	79.8	435
Eden Landing	E8	0.0	100.0	0.0	0.0	0.0	7
Eden Landing	E8AW	100.0	0.0	0.0	0.0	0.0	1
Eden Landing	E8XN	100.0	0.0	0.0	0.0	0.0	5
Eden Landing	E9	45.5	45.5	0.0	0.0	9.1	11
Mowry	M1	26.7	20.0	0.0	52.2	1.1	90
Mowry	M2	1.9	1.9	5.6	90.7	0.0	54
Mowry	M3	0.0	100.0	0.0	0.0	0.0	3
Ravenswood	R1	24.0	75.3	0.7	0.0	0.0	267
Ravenswood	R3	50.0	50.0	0.0	0.0	0.0	4
Ravenswood	RSF2U1	15.0	5.0	0.0	70.0	10.0	20
Ravenswood	RSF2U2	31.2	4.2	54.2	10.4	0.0	48
Ravenswood	RSF2U4	100.0	0.0	0.0	0.0	0.0	1

Table 9. Percentage of gulls foraging, roosting, and using islands, levees, or manmade structures (e.g., blinds, fence posts) in each pond, South San Francisco Bay, California; September 2022 - May 2023. N is the total number of bird sightings during the study period. Only ponds with one or more sightings are shown. Pond CP3C is in the Eden Landing area but owned by Cargill.

Complex	Pond	% Foraging	% Roosting	% Island	% Levee	% Manmade	N
Alviso	A1	0.6	66.9	0.0	0.0	32.5	160
Alviso	A10	0.9	1.7	2.6	94.8	0.0	231
Alviso	A11	1.0	20.7	0.0	78.2	0.0	193
Alviso	A12	0.0	74.2	25.0	0.7	0.0	5259
Alviso	A13	3.8	95.4	0.8	0.0	0.0	2362
Alviso	A14	4.9	20.1	0.0	75.1	0.0	309
Alviso	A15	18.8	78.9	2.1	0.2	0.0	2937
Alviso	A16	0.8	56.0	42.1	0.0	1.0	1310
Alviso	A17	11.6	88.4	0.0	0.0	0.0	242
Alviso	A19	16.8	83.2	0.0	0.0	0.0	1889
Alviso	A22	2.5	68.6	0.0	28.9	0.0	1785
Alviso	A23	1.6	41.8	0.0	56.6	0.0	2943
Alviso	A2E	2.2	3.5	0.7	90.7	2.9	1832
Alviso	A2W	3.1	31.2	0.0	0.0	65.6	32
Alviso	A3N	1.0	67.2	0.0	1.0	30.7	192
Alviso	A3W	0.4	8.3	0.0	63.7	27.6	796
Alviso	A5	0.8	6.0	0.0	93.1	0.0	5628
Alviso	A6S	15.0	80.0	0.0	0.0	5.0	40
Alviso	A7	3.7	4.8	8.0	83.4	0.1	4213
Alviso	A8	7.1	9.8	0.0	82.7	0.3	1107
Alviso	A8S	1.8	23.3	0.0	74.9	0.0	1477
Alviso	A8W	0.0	8.0	0.0	92.0	0.0	761
Alviso	A9	35.0	64.1	0.0	0.9	0.0	449
Alviso	AB1	29.2	50.4	2.7	6.2	11.5	113
Alviso	AB2	0.9	12.3	13.9	71.6	1.2	5452
Coyote Hills	N1A	4.1	4.1	0.0	91.5	0.3	294
Coyote Hills	N2A	1.0	13.5	0.0	85.5	0.0	2616
Coyote Hills	N3A	0.9	1.6	0.0	97.5	0.0	4311
Coyote Hills	N4	0.0	5.5	0.0	94.5	0.0	219
Coyote Hills	N4AA	5.3	7.0	0.6	78.4	8.8	171

Coyote Hills	N4AB	0.5	12.2	0.0	87.3	0.0	3151
Coyote Hills	N4B	100.0	0.0	0.0	0.0	0.0	866
Coyote Hills	N5	0.4	17.0	0.0	82.2	0.4	270
Coyote Hills	N6	0.0	6.1	0.0	93.9	0.0	5034
Coyote Hills	N7	0.8	0.7	0.0	98.5	0.0	2962
Coyote Hills	N8	3.5	6.6	0.0	89.9	0.0	742
Coyote Hills	N9	0.0	12.5	2.3	85.2	0.0	1277
Dumbarton	N1	71.6	25.1	1.4	1.4	0.5	211
Dumbarton	N2	22.6	62.0	14.3	1.1	0.0	350
Dumbarton	N3	36.3	2.4	36.3	12.9	12.1	124
Dumbarton	NPP1	63.0	36.7	0.0	0.3	0.0	330
Eden Landing	E1	4.5	80.9	4.5	7.3	2.7	110
Eden Landing	E10	18.2	68.2	0.0	0.0	13.6	22
Eden Landing	E11	3.7	96.3	0.0	0.0	0.0	268
Eden Landing	E12	3.3	51.7	32.1	12.9	0.0	240
Eden Landing	E13	0.0	100.0	0.0	0.0	0.0	1
Eden Landing	E1C	0.0	100.0	0.0	0.0	0.0	6
Eden Landing	E2	33.3	19.3	41.5	4.1	1.8	171
Eden Landing	E2C	0.0	100.0	0.0	0.0	0.0	2
Eden Landing	CP3C	2.2	97.8	0.0	0.0	0.0	546
Eden Landing	E4	0.0	97.8	0.0	0.0	2.2	138
Eden Landing	E4C	15.5	65.9	15.5	0.0	3.1	387
Eden Landing	E5	91.5	6.2	0.0	0.4	1.8	224
Eden Landing	E5C	47.1	52.9	0.0	0.0	0.0	189
Eden Landing	E6	12.7	81.4	0.0	0.0	6.0	671
Eden Landing	E6A	0.5	88.2	1.0	0.0	10.3	204
Eden Landing	E6B	0.0	100.0	0.0	0.0	0.0	3
Eden Landing	E6C	100.0	0.0	0.0	0.0	0.0	1
Eden Landing	E7	0.0	86.8	0.0	0.0	13.2	53
Eden Landing	E8	0.0	100.0	0.0	0.0	0.0	5
Eden Landing	E8AE	50.0	50.0	0.0	0.0	0.0	2
Eden Landing	E9	88.1	10.7	0.0	0.0	1.2	244
Mowry	M1	11.7	1.3	0.0	87.0	0.0	1583
Mowry	M2	0.5	13.4	15.4	70.7	0.0	3219

Mowry	M3	30.5	7.0	17.3	44.6	0.6	2168
Mowry	M4	32.1	11.2	3.3	53.3	0.1	3987
Mowry	M5	49.8	0.5	0.0	49.4	0.3	3035
Mowry	M6	13.6	4.4	1.5	60.0	20.5	913
Ravenswood	R1	16.8	83.2	0.0	0.0	0.0	895
Ravenswood	R2	74.4	25.6	0.0	0.0	0.0	82
Ravenswood	R3	0.0	100.0	0.0	0.0	0.0	1
Ravenswood	R4	0.0	100.0	0.0	0.0	0.0	14
Ravenswood	RSF2U1	3.0	1.7	82.7	8.7	3.8	757
Ravenswood	RSF2U2	1.7	1.3	61.6	35.3	0.0	232
Ravenswood	RSF2U3	7.7	92.3	0.0	0.0	0.0	13
Ravenswood	RSF2U4	0.0	0.0	0.0	100.0	0.0	1

Table 10. Percentage of herons and egrets foraging, roosting, and using islands, levees, or manmade structures (e.g., blinds, fence posts) in each pond, South San Francisco Bay, California; September 2022 - May 2023. N is the total number of bird sightings during the study period. Only ponds with one or more sightings are shown. Pond CP3C is in the Eden Landing area but owned by Cargill.

Complex	Pond	% Foraging	% Roosting	% Island	% Levee	% Manmade	N
Alviso	A1	38.5	19.2	0.0	40.4	1.9	52
Alviso	A10	33.3	46.7	0.0	20.0	0.0	75
Alviso	A11	45.6	22.8	0.0	31.6	0.0	57
Alviso	A14	50.7	4.1	0.0	35.6	9.6	73
Alviso	A15	14.3	85.7	0.0	0.0	0.0	7
Alviso	A16	58.0	24.9	13.0	1.6	2.6	193
Alviso	A17	66.7	16.7	0.0	16.7	0.0	6
Alviso	A19	50.0	50.0	0.0	0.0	0.0	2
Alviso	A23	33.3	0.0	0.0	66.7	0.0	3
Alviso	A2E	46.3	8.4	0.0	38.9	6.3	95
Alviso	A2W	28.6	25.7	0.0	40.0	5.7	35
Alviso	A3N	33.3	50.0	0.0	8.3	8.3	12
Alviso	A3W	73.6	8.8	0.0	7.7	9.9	91
Alviso	A5	35.4	31.3	0.0	31.3	2.0	99
Alviso	A6S	20.0	73.3	0.0	6.7	0.0	15
Alviso	A7	47.3	28.4	0.0	23.0	1.4	74
Alviso	A8	50.0	6.2	18.8	18.8	6.2	16
Alviso	A8S	12.9	3.5	0.0	83.5	0.0	85
Alviso	A8W	27.3	18.2	0.0	54.5	0.0	11
Alviso	A9	89.9	8.4	0.0	1.1	0.6	179
Alviso	AB1	90.9	4.5	0.0	1.3	3.2	154
Alviso	AB2	80.6	6.9	2.8	4.2	5.6	72
Coyote Hills	N1A	56.8	13.6	0.0	27.3	2.3	44
Coyote Hills	N2A	54.5	36.4	0.0	9.1	0.0	11
Coyote Hills	N3A	69.0	6.9	0.0	24.1	0.0	29
Coyote Hills	N4	69.6	21.7	2.2	4.3	2.2	46
Coyote Hills	N4AA	82.0	4.0	0.0	10.0	4.0	50
Coyote Hills	N4AB	70.7	0.0	4.9	24.4	0.0	41
Coyote Hills	N4B	72.6	13.7	0.0	6.8	6.8	73
Coyote Hills	N5	50.0	12.5	0.0	37.5	0.0	8
Coyote Hills	N6	62.5	18.8	0.0	18.8	0.0	16
Coyote Hills	N7	34.8	13.0	0.0	52.2	0.0	23
Coyote Hills	N8	25.0	25.0	0.0	50.0	0.0	16
Coyote Hills	N9	30.8	23.1	3.8	42.3	0.0	26

Dumbarton	N1	0.0	0.0	0.0	100.0	0.0	2
Dumbarton	N2	0.0	0.0	0.0	100.0	0.0	3
Dumbarton	N3	100.0	0.0	0.0	0.0	0.0	8
Eden Landing	E1	83.5	11.4	0.0	2.5	2.5	79
Eden Landing	E10	71.4	12.2	6.1	6.1	4.1	49
Eden Landing	E11	80.8	15.4	0.0	3.8	0.0	26
Eden Landing	E12	30.8	44.2	1.9	21.2	1.9	52
Eden Landing	E13	68.8	25.0	0.0	6.2	0.0	16
Eden Landing	E14	100.0	0.0	0.0	0.0	0.0	2
Eden Landing	E1C	50.0	50.0	0.0	0.0	0.0	4
Eden Landing	E2	65.5	14.5	3.6	12.7	3.6	55
Eden Landing	E2C	37.5	37.5	0.0	25.0	0.0	8
Eden Landing	CP3C	95.0	5.0	0.0	0.0	0.0	20
Eden Landing	E4	36.4	9.1	0.0	0.0	54.5	11
Eden Landing	E5	100.0	0.0	0.0	0.0	0.0	5
Eden Landing	E6	0.0	0.0	0.0	100.0	0.0	1
Eden Landing	E6A	79.0	17.3	0.0	0.0	3.7	81
Eden Landing	E6B	89.5	10.5	0.0	0.0	0.0	19
Eden Landing	E6C	100.0	0.0	0.0	0.0	0.0	2
Eden Landing	E7	20.0	5.0	0.0	45.0	30.0	20
Eden Landing	E8	76.5	17.6	0.0	5.9	0.0	17
Eden Landing	E8AE	71.4	14.3	0.0	0.0	14.3	7
Eden Landing	E8AW	66.7	33.3	0.0	0.0	0.0	12
Eden Landing	E8XN	76.9	15.4	0.0	7.7	0.0	13
Eden Landing	E8XS	100.0	0.0	0.0	0.0	0.0	3
Eden Landing	E9	47.6	28.6	0.0	23.8	0.0	21
Mowry	M1	33.3	44.4	0.0	11.1	11.1	9
Mowry	M2	100.0	0.0	0.0	0.0	0.0	1
Ravenswood	R1	68.0	28.7	0.6	0.6	2.2	181
Ravenswood	R2	50.0	50.0	0.0	0.0	0.0	2
Ravenswood	R5	25.0	75.0	0.0	0.0	0.0	8
Ravenswood	R5S	100.0	0.0	0.0	0.0	0.0	3
Ravenswood	RSF2U1	27.8	25.0	38.9	5.6	2.8	36
Ravenswood	RSF2U2	63.0	0.0	37.0	0.0	0.0	27
Ravenswood	RSF2U3	100.0	0.0	0.0	0.0	0.0	2
Ravenswood	RSF2U4	61.5	23.1	0.0	7.7	7.7	13

Table 11. Percentage of phalaropes foraging, roosting, and using islands, levees, or manmade structures (e.g., blinds, fence posts) in each pond, South San Francisco Bay, California; September 2022 - May 2023. N is the total number of bird sightings during the study period. Only ponds with one or more sightings are shown. Pond CP3C is in the Eden Landing area but owned by Cargill.

Complex	Pond	% Foraging	% Roosting	% Island	% Levee	% Manmade	N
Alviso	A22	30.0	70.0	0	0	0	10
Alviso	A9	100.0	0.0	0	0	0	9
Coyote Hills	N4	100.0	0.0	0	0	0	12
Eden Landing	E14	100.0	0.0	0	0	0	3
Eden Landing	E2	90.5	9.5	0	0	0	1056
Eden Landing	CP3C	20.0	80.0	0	0	0	5
Eden Landing	E4	100.0	0.0	0	0	0	2611
Eden Landing	E5C	100.0	0.0	0	0	0	148
Eden Landing	E6	31.2	68.8	0	0	0	234
Eden Landing	E6B	100.0	0.0	0	0	0	118
Eden Landing	E7	0.0	100.0	0	0	0	29
Eden Landing	E8	100.0	0.0	0	0	0	41
Mowry	M1	0.0	100.0	0	0	0	19
Mowry	M2	100.0	0.0	0	0	0	491
Mowry	M4	100.0	0.0	0	0	0	11
Mowry	M6	22.2	77.8	0	0	0	90
Ravenswood	R1	100.0	0.0	0	0	0	162
Ravenswood	R2	100.0	0.0	0	0	0	6
Ravenswood	R4	26.7	73.3	0	0	0	15

Table 12. Percentage of medium shorebirds foraging, roosting, and using islands, levees, or manmade structures (e.g., blinds, fence posts) in each pond, South San Francisco Bay, California; September 2022 - May 2023. N is the total number of bird sightings during the study period. Only ponds with one or more sightings are shown. Pond CP3C is in the Eden Landing area but owned by Cargill.

Complex	Pond	% Foraging	% Roosting	% Island	% Levee	% Manmade	N
Alviso	A1	0.0	100.0	0.0	0.0	0.0	3
Alviso	A10	66.7	8.3	0.0	25.0	0.0	12
Alviso	A11	3.8	1.9	0.0	94.2	0.0	52
Alviso	A12	4.1	2.0	93.9	0.0	0.0	49
Alviso	A13	47.1	52.9	0.0	0.0	0.0	119
Alviso	A14	30.8	9.7	0.0	59.5	0.0	341
Alviso	A15	44.8	48.3	6.9	0.0	0.0	29
Alviso	A16	14.5	81.4	4.1	0.0	0.0	967
Alviso	A17	59.3	40.7	0.0	0.0	0.0	2905
Alviso	A19	67.9	32.1	0.0	0.0	0.0	941
Alviso	A22	59.9	39.1	0.5	0.5	0.0	2320
Alviso	A23	54.9	45.1	0.0	0.0	0.0	570
Alviso	A2E	38.3	26.2	0.0	35.5	0.0	141
Alviso	A2W	38.9	61.1	0.0	0.0	0.0	18
Alviso	A3N	6.0	93.9	0.0	0.1	0.0	1986
Alviso	A3W	14.9	85.0	0.0	0.1	0.0	960
Alviso	A5	4.5	3.4	0.0	92.2	0.0	179
Alviso	A6S	31.2	68.8	0.0	0.0	0.0	1006
Alviso	A7	56.6	8.5	2.8	32.1	0.0	106
Alviso	A8	1.7	94.8	0.0	3.4	0.0	58
Alviso	A8S	16.7	2.8	0.0	80.6	0.0	36
Alviso	A8W	50.0	8.3	0.0	41.7	0.0	12
Alviso	A9	47.4	52.5	0.0	0.1	0.0	9098
Alviso	AB1	16.8	83.1	0.1	0.1	0.0	1730
Alviso	AB2	30.4	67.7	1.1	0.8	0.0	2057
Coyote Hills	N1A	4.5	0.0	0.0	95.5	0.0	22
Coyote Hills	N2A	0.0	0.0	0.0	100.0	0.0	2
Coyote Hills	N3A	8.0	88.3	0.0	3.1	0.6	162
Coyote Hills	N4	0.1	74.9	24.9	0.0	0.0	4845
Coyote Hills	N4AA	43.3	23.3	25.6	7.8	0.0	90

Complex	Pond	% Foraging	% Roosting	% Island	% Levee	% Manmade	N
Coyote Hills	N4AB	100.0	0.0	0.0	0.0	0.0	1
Coyote Hills	N4B	82.1	10.3	0.0	7.7	0.0	39
Coyote Hills	N5	0.0	0.0	0.0	100.0	0.0	19
Coyote Hills	N6	83.3	6.7	0.0	10.0	0.0	30
Coyote Hills	N7	0.0	100.0	0.0	0.0	0.0	1
Coyote Hills	N8	0.4	0.0	0.0	99.6	0.0	267
Coyote Hills	N9	15.3	59.5	0.0	25.2	0.0	274
Dumbarton	N1	26.7	6.7	35.8	0.5	30.3	1032
Dumbarton	N2	36.0	44.0	20.0	0.0	0.0	50
Dumbarton	N3	13.0	23.6	47.6	15.8	0.0	3413
Dumbarton	NPP1	33.2	53.3	12.8	0.6	0.0	1091
Eden Landing	E1	0.6	0.3	0.6	98.4	0.0	310
Eden Landing	E10	35.0	63.1	0.6	0.0	1.3	2654
Eden Landing	E11	32.8	66.4	0.0	0.0	0.8	5874
Eden Landing	E12	13.4	50.7	12.8	6.7	16.4	2657
Eden Landing	E13	17.1	49.1	3.3	4.5	25.9	1255
Eden Landing	E14	60.0	40.0	0.0	0.0	0.0	20
Eden Landing	E1C	54.6	45.4	0.0	0.0	0.0	447
Eden Landing	E2	47.6	1.5	50.7	0.2	0.0	527
Eden Landing	E2C	41.6	58.4	0.0	0.0	0.0	421
Eden Landing	CP3C	23.6	48.3	0.0	0.0	28.1	948
Eden Landing	E4	3.6	96.1	0.1	0.0	0.2	1369
Eden Landing	E4C	57.0	23.5	0.0	0.0	19.5	2141
Eden Landing	E5	92.9	6.9	0.0	0.0	0.2	1099
Eden Landing	E5C	27.2	72.7	0.0	0.1	0.0	766
Eden Landing	E6	32.5	66.9	0.0	0.0	0.6	1882
Eden Landing	E6A	40.1	59.4	0.0	0.2	0.3	977
Eden Landing	E6B	9.8	90.0	0.0	0.1	0.1	1117
Eden Landing	E7	14.5	48.6	0.0	0.3	36.6	325
Eden Landing	E8	18.4	61.3	0.0	0.0	20.3	2047
Eden Landing	E8AE	48.1	51.7	0.0	0.0	0.1	808
Eden Landing	E8AW	7.0	93.0	0.0	0.0	0.0	2895
Eden Landing	E8XN	0.0	100.0	0.0	0.0	0.0	1

Complex	Pond	% Foraging	% Roosting	% Island	% Levee	% Manmade	N
Eden Landing	E8XS	50.0	50.0	0.0	0.0	0.0	4
Eden Landing	E9	5.1	94.9	0.0	0.0	0.0	12427
Mowry	M1	0.0	0.0	0.0	100.0	0.0	3546
Mowry	M2	0.4	3.6	19.1	77.0	0.0	4886
Mowry	M3	14.5	30.0	54.1	1.3	0.0	447
Mowry	M4	45.3	18.1	0.0	36.6	0.0	254
Mowry	M5	93.2	0.3	4.8	1.8	0.0	399
Mowry	M6	89.5	9.9	0.0	0.6	0.0	1144
Ravenswood	R1	17.6	82.4	0.0	0.0	0.0	7366
Ravenswood	R2	94.4	5.6	0.0	0.0	0.0	728
Ravenswood	R3	13.9	85.9	0.0	0.2	0.0	940
Ravenswood	R4	25.4	67.1	7.4	0.0	0.0	2067
Ravenswood	R5	11.6	88.4	0.0	0.0	0.0	43
Ravenswood	R5S	30.2	69.8	0.0	0.0	0.0	63
Ravenswood	RSF2U1	1.7	63.7	19.9	14.6	0.1	5404
Ravenswood	RSF2U2	1.0	1.8	92.4	4.8	0.0	14620
Ravenswood	RSF2U3	27.9	70.5	0.0	1.6	0.0	129
Ravenswood	RSF2U4	44.3	55.7	0.0	0.0	0.0	291

Table 13. Percentage of small shorebirds foraging, roosting, and using islands, levees, or manmade structures (e.g., blinds, fence posts) in each pond, South San Francisco Bay, California; September 2022 - May 2023. N is the total number of bird sightings during the study period. Only ponds with one or more sightings are shown. Pond CP3C is in the Eden Landing area but owned by Cargill.

Complex	Pond	% Foraging	% Roosting	% Island	% Levee	% Manmade	N
Alviso	A10	46.3	23.1	0.0	30.6	0.0	147
Alviso	A11	43.8	0.0	0.0	56.2	0.0	73
Alviso	A12	82.2	15.6	0.0	2.2	0.0	45
Alviso	A13	76.8	22.9	0.0	0.3	0.0	7750
Alviso	A14	69.4	24.1	0.0	6.5	0.0	415
Alviso	A15	49.0	50.0	0.1	0.9	0.0	10989
Alviso	A16	24.8	73.2	2.0	0.0	0.0	3230
Alviso	A17	88.7	11.3	0.0	0.0	0.0	707
Alviso	A19	100.0	0.0	0.0	0.0	0.0	40
Alviso	A22	37.2	62.8	0.0	0.0	0.0	2563
Alviso	A23	87.3	12.7	0.0	0.0	0.0	1470
Alviso	A2E	30.1	69.9	0.0	0.0	0.0	662
Alviso	A2W	43.3	56.7	0.0	0.0	0.0	141
Alviso	A3N	38.8	61.2	0.0	0.0	0.0	8179
Alviso	A3W	29.9	69.9	0.0	0.0	0.2	5963
Alviso	A5	33.0	10.9	0.0	56.2	0.0	349
Alviso	A6S	80.3	16.1	0.0	3.5	0.2	579
Alviso	A7	88.9	6.0	0.0	5.0	0.0	199
Alviso	A8	0.0	0.0	0.0	100.0	0.0	1
Alviso	A8S	0.0	47.4	0.0	52.6	0.0	19
Alviso	A8W	91.1	0.0	0.0	8.9	0.0	45
Alviso	A9	40.9	59.1	0.0	0.0	0.0	65447
Alviso	AB1	76.1	22.5	1.4	0.0	0.0	9573
Alviso	AB2	74.3	24.0	0.8	0.8	0.0	9786
Coyote Hills	N1A	0.0	0.0	0.0	100.0	0.0	10
Coyote Hills	N2A	0.0	16.7	0.0	83.3	0.0	6
Coyote Hills	N3A	79.6	20.0	0.0	0.4	0.0	1051
Coyote Hills	N4	62.4	36.5	0.6	0.4	0.1	713
Coyote Hills	N4AA	96.0	3.6	0.0	0.0	0.4	550
Coyote Hills	N4AB	0.0	100.0	0.0	0.0	0.0	10
Coyote Hills	N4B	89.2	10.8	0.0	0.0	0.0	74
Coyote Hills	N5	39.3	33.3	0.0	27.4	0.0	219

Complex	Pond	% Foraging	% Roosting	% Island	% Levee	% Manmade	N
Coyote Hills	N6	91.8	8.2	0.0	0.0	0.0	1033
Coyote Hills	N7	57.5	8.2	0.0	34.2	0.0	73
Coyote Hills	N8	10.6	0.0	0.0	89.4	0.0	282
Coyote Hills	N9	48.4	9.4	0.2	41.9	0.0	1664
Dumbarton	N1	18.7	64.4	16.1	0.4	0.4	1031
Dumbarton	N2	63.4	14.2	21.8	0.6	0.0	344
Dumbarton	N3	2.9	10.6	39.5	46.9	0.0	7467
Dumbarton	NPP1	31.7	64.1	3.6	0.6	0.0	22397
Eden Landing	E1	29.0	2.0	68.3	0.7	0.0	407
Eden Landing	E10	68.9	31.1	0.0	0.0	0.0	1871
Eden Landing	E11	49.5	50.5	0.0	0.0	0.0	3750
Eden Landing	E12	16.9	70.1	8.4	4.6	0.1	13555
Eden Landing	E13	33.1	53.1	0.3	13.3	0.3	13771
Eden Landing	E14	53.9	46.1	0.0	0.0	0.0	12371
Eden Landing	E1C	50.3	49.6	0.0	0.0	0.1	5237
Eden Landing	E2	59.0	4.1	37.0	0.0	0.0	1131
Eden Landing	E2C	79.3	20.7	0.0	0.0	0.0	1670
Eden Landing	CP3C	57.1	42.6	0.0	0.0	0.2	7466
Eden Landing	E4	21.1	78.3	0.0	0.0	0.6	17582
Eden Landing	E4C	16.3	78.9	0.2	0.0	4.6	18671
Eden Landing	E5	75.1	18.2	0.0	0.0	6.7	1104
Eden Landing	E5C	62.7	36.6	0.0	0.4	0.3	2603
Eden Landing	E6	67.2	32.7	0.0	0.0	0.2	3116
Eden Landing	E6A	64.3	35.7	0.0	0.0	0.0	18230
Eden Landing	E6B	20.4	79.6	0.0	0.0	0.0	14169
Eden Landing	E6C	43.8	22.5	0.0	33.7	0.0	520
Eden Landing	E7	67.7	27.3	0.2	0.0	4.8	418
Eden Landing	E8	18.9	79.9	0.0	0.0	1.2	9670
Eden Landing	E8AE	56.5	43.5	0.0	0.0	0.0	3092
Eden Landing	E8AW	26.2	73.8	0.0	0.0	0.0	5398
Eden Landing	E8XS	82.6	17.4	0.0	0.0	0.0	351
Eden Landing	E9	41.6	58.4	0.0	0.0	0.0	26905
Mowry	M1	0.3	0.0	0.0	99.7	0.0	17917
Mowry	M2	0.0	0.1	15.7	84.1	0.0	20872
Mowry	M3	24.7	5.7	40.0	29.5	0.1	2102
Mowry	M4	71.0	2.8	0.0	26.0	0.1	822

Complex	Pond	% Foraging	% Roosting	% Island	% Levee	% Manmade	N
Mowry	M5	60.3	14.4	20.1	4.6	0.6	174
Mowry	M6	89.9	10.1	0.0	0.0	0.0	2338
Ravenswood	R1	40.0	59.9	0.0	0.1	0.0	120502
Ravenswood	R2	75.2	24.8	0.0	0.0	0.0	640
Ravenswood	R3	17.2	82.8	0.0	0.0	0.0	4949
Ravenswood	R4	34.4	51.7	13.9	0.0	0.0	12424
Ravenswood	R5	51.8	48.2	0.0	0.0	0.0	276
Ravenswood	R5S	9.9	90.1	0.0	0.0	0.0	1350
Ravenswood	RSF2U1	0.0	49.9	41.1	9.0	0.0	802
Ravenswood	RSF2U2	2.9	78.5	18.1	0.4	0.0	452
Ravenswood	RSF2U3	38.1	61.9	0.0	0.0	0.0	5860
Ravenswood	RSF2U4	81.1	18.9	0.0	0.0	0.0	1439

Table 14. Percentage of terns foraging, roosting, and using islands, levees, or manmade structures (e.g., blinds, fence posts) in each pond, South San Francisco Bay, California; September 2022 - May 2023. N is the total number of bird sightings during the study period. Only ponds with one or more sightings are shown. Pond CP3C is in the Eden Landing area but owned by Cargill.

Complex	Pond	% Foraging	% Roosting	% Island	% Levee	% Manmade	N
Alviso	A1	12.5	4.2	0.0	0.0	83.3	24
Alviso	A10	66.0	0.0	0.0	34.0	0.0	94
Alviso	A11	35.3	0.0	0.0	64.7	0.0	51
Alviso	A13	0.0	0.0	81.8	0.0	18.2	11
Alviso	A14	4.8	0.0	0.0	95.2	0.0	392
Alviso	A15	100.0	0.0	0.0	0.0	0.0	2
Alviso	A16	20.6	11.9	49.4	0.0	18.1	646
Alviso	A2E	47.4	0.0	5.2	0.0	47.4	97
Alviso	A2W	10.4	0.0	0.0	0.0	89.6	298
Alviso	A3N	75.0	25.0	0.0	0.0	0.0	4
Alviso	A3W	31.8	33.5	0.0	0.0	34.7	170
Alviso	A5	47.0	0.0	0.0	53.0	0.0	100
Alviso	A7	56.2	0.0	0.0	40.0	3.8	130
Alviso	A8	7.0	0.0	0.0	92.5	0.5	374
Alviso	A8S	1.3	17.1	0.0	81.6	0.0	380
Alviso	A8W	2.0	0.0	0.0	98.0	0.0	202
Alviso	A9	10.9	89.1	0.0	0.0	0.0	101
Alviso	AB1	72.7	9.1	0.0	0.0	18.2	11
Alviso	AB2	100.0	0.0	0.0	0.0	0.0	2
Coyote Hills	N1A	26.1	0.0	0.0	73.4	0.5	188
Coyote Hills	N2A	50.0	0.0	0.0	50.0	0.0	12
Coyote Hills	N3A	6.4	0.0	0.0	85.5	8.1	234
Coyote Hills	N4	33.3	0.0	0.0	0.0	66.7	6
Coyote Hills	N4AA	25.9	40.0	0.0	2.2	31.8	490
Coyote Hills	N4AB	87.5	0.0	0.0	12.5	0.0	16
Coyote Hills	N5	50.0	0.0	0.0	0.0	50.0	2
Coyote Hills	N6	100.0	0.0	0.0	0.0	0.0	2
Coyote Hills	N7	50.0	0.0	0.0	0.0	50.0	6
Coyote Hills	N8	100.0	0.0	0.0	0.0	0.0	2
Coyote Hills	N9	100.0	0.0	0.0	0.0	0.0	16
Dumbarton	N1	0.0	0.0	50.0	0.0	50.0	4
Dumbarton	N3	0.0	50.0	50.0	0.0	0.0	2

Complex	Pond	% Foraging	% Roosting	% Island	% Levee	% Manmade	N
Eden Landing	E1	45.3	3.8	13.2	0.0	37.7	53
Eden Landing	E10	0.0	0.0	0.0	0.0	100.0	34
Eden Landing	E11	80.0	0.0	0.0	0.0	20.0	5
Eden Landing	E12	9.1	9.1	24.2	0.0	57.6	33
Eden Landing	E13	30.0	0.0	20.0	43.3	6.7	30
Eden Landing	E14	66.7	33.3	0.0	0.0	0.0	6
Eden Landing	E2	63.2	1.8	4.4	0.0	30.7	114
Eden Landing	CP3C	100.0	0.0	0.0	0.0	0.0	3
Eden Landing	E4	13.3	86.7	0.0	0.0	0.0	15
Eden Landing	E5	84.6	0.0	0.0	0.0	15.4	13
Eden Landing	E6A	50.0	0.0	0.0	0.0	50.0	38
Eden Landing	E6B	100.0	0.0	0.0	0.0	0.0	3
Eden Landing	E6C	27.3	0.0	0.0	0.0	72.7	11
Eden Landing	E7	0.7	9.6	0.0	0.0	89.7	758
Eden Landing	E8AW	100.0	0.0	0.0	0.0	0.0	3
Eden Landing	E8XN	100.0	0.0	0.0	0.0	0.0	1
Eden Landing	E9	69.2	30.8	0.0	0.0	0.0	13
Mowry	M1	23.8	55.8	0.0	14.3	6.1	147
Mowry	M2	0.0	0.0	81.0	18.5	0.6	168
Mowry	M3	0.0	100.0	0.0	0.0	0.0	2
Ravenswood	R1	55.7	44.3	0.0	0.0	0.0	106
Ravenswood	R2	100.0	0.0	0.0	0.0	0.0	2
Ravenswood	R4	0.0	100.0	0.0	0.0	0.0	4
Ravenswood	R5	100.0	0.0	0.0	0.0	0.0	1
Ravenswood	R5S	100.0	0.0	0.0	0.0	0.0	1
Ravenswood	RSF2U1	8.8	1.8	22.8	4.4	62.3	114
Ravenswood	RSF2U2	0.3	5.1	89.8	4.8	0.0	332
Ravenswood	RSF2U4	100.0	0.0	0.0	0.0	0.0	4

Table 15. Summary of recent three-year average (ending in Data Year) waterbird trends compared with SBSPRP targets or baseline values (2005–2007). Season = the season in which the species/guild counts are highest; SBSPRP target = baseline count defined by the SBSPRP Adaptive Management Plan (SBSPRP 2007). Targets for dabbling ducks and medium shorebirds were not defined in the Adaptive Management Plan, so we assumed that baseline values were the mean count per survey in 2005–2007 (denoted by *); Threshold = NEPA/CEQA significance threshold; Data year = the most recent year with data collected during the relevant season; Percent change = percent difference between recent counts (most recent three-year average) and SBSPRP targets or baseline values; Trigger = true if a trigger was detected, where two out of the most recent three consecutive years had counts below baseline values for most species/guilds. The trigger for PHAL, BOGU, and EAGR was three consecutive years more than 25% below NEPA/CEQA baseline, or any single year more than 50% below NEPA/CEQA baseline. Because of COVID-19 restrictions, winter 2020 season surveys were not completed, so two-year averages are provided. Phalaropes trigger is TRUE based on targeted summer surveys (Burns and Van Schmidt 2023, Burns et al. 2023).

Species/Guild	**Season**	**SBSPRP Target**	**Threshold**	**Percent Change**	**Trigger**
Ruddy ducks	Winter	12602	-15%	159%	FALSE
diving ducks	Winter	39645	-20%	53%	FALSE
small shorebirds	Fall	60623	-20%	70%	FALSE
small shorebirds	Spring	73728	-20%	27%	FALSE
Eared grebes	Winter	5640	-50% / -25%	76% / 48%	FALSE
phalaropes	Summer	3225	-50% / -25%	-77% / -75%^ (in 2022; from Burns & Van Schmidt 2023)	TRUE
Bonaparte's gulls	Winter	1270	-50% / -25%	40% / -62%	TRUE
dabbling ducks	Winter	48524*	NA	-18%	FALSE
medium shorebirds	Winter	23312*	NA	-2%	FALSE

Figures

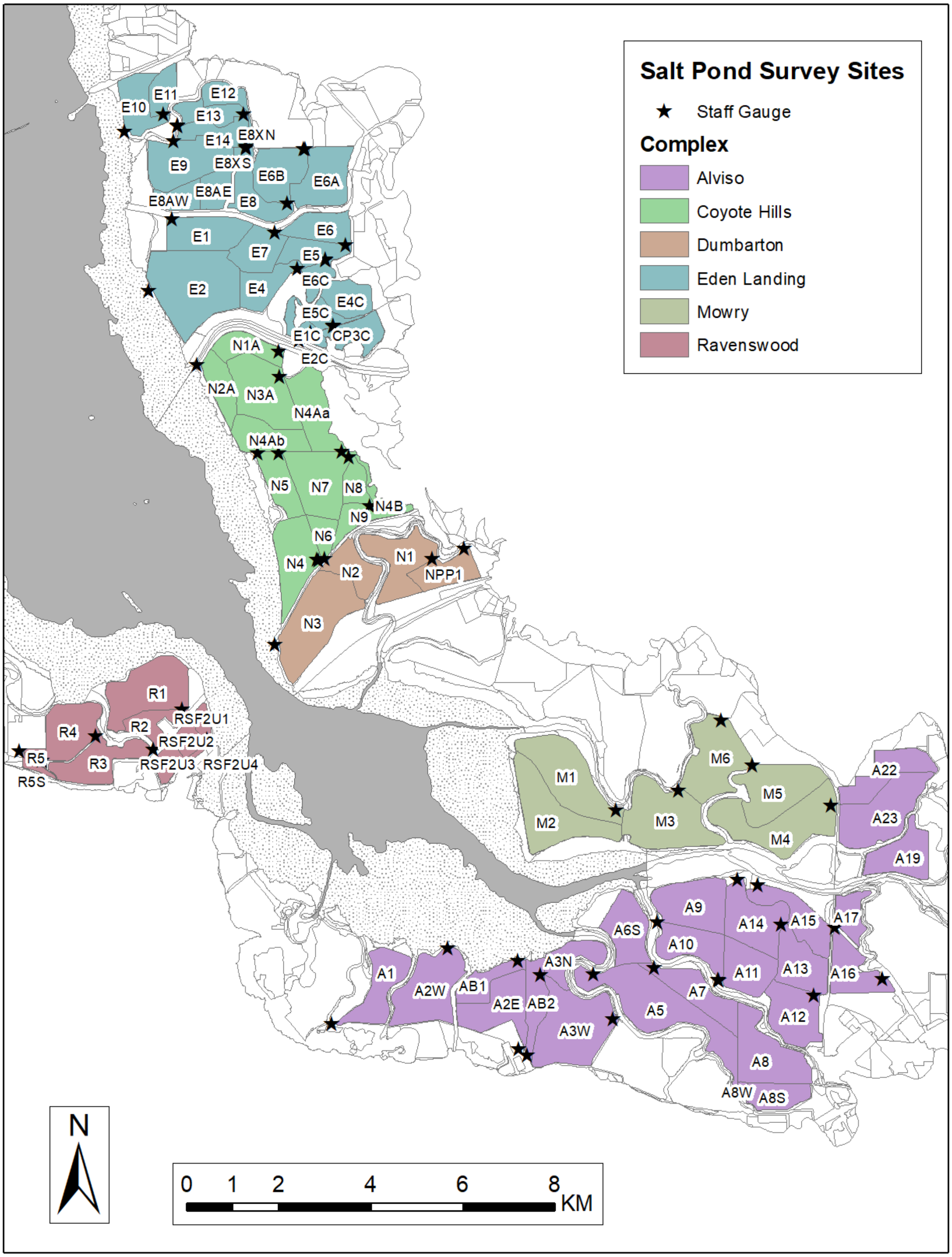

Figure 1. Map of the study area and all ponds surveyed by the San Francisco Bay Bird Observatory from September 2022–May 2023, South San Francisco Bay, California.

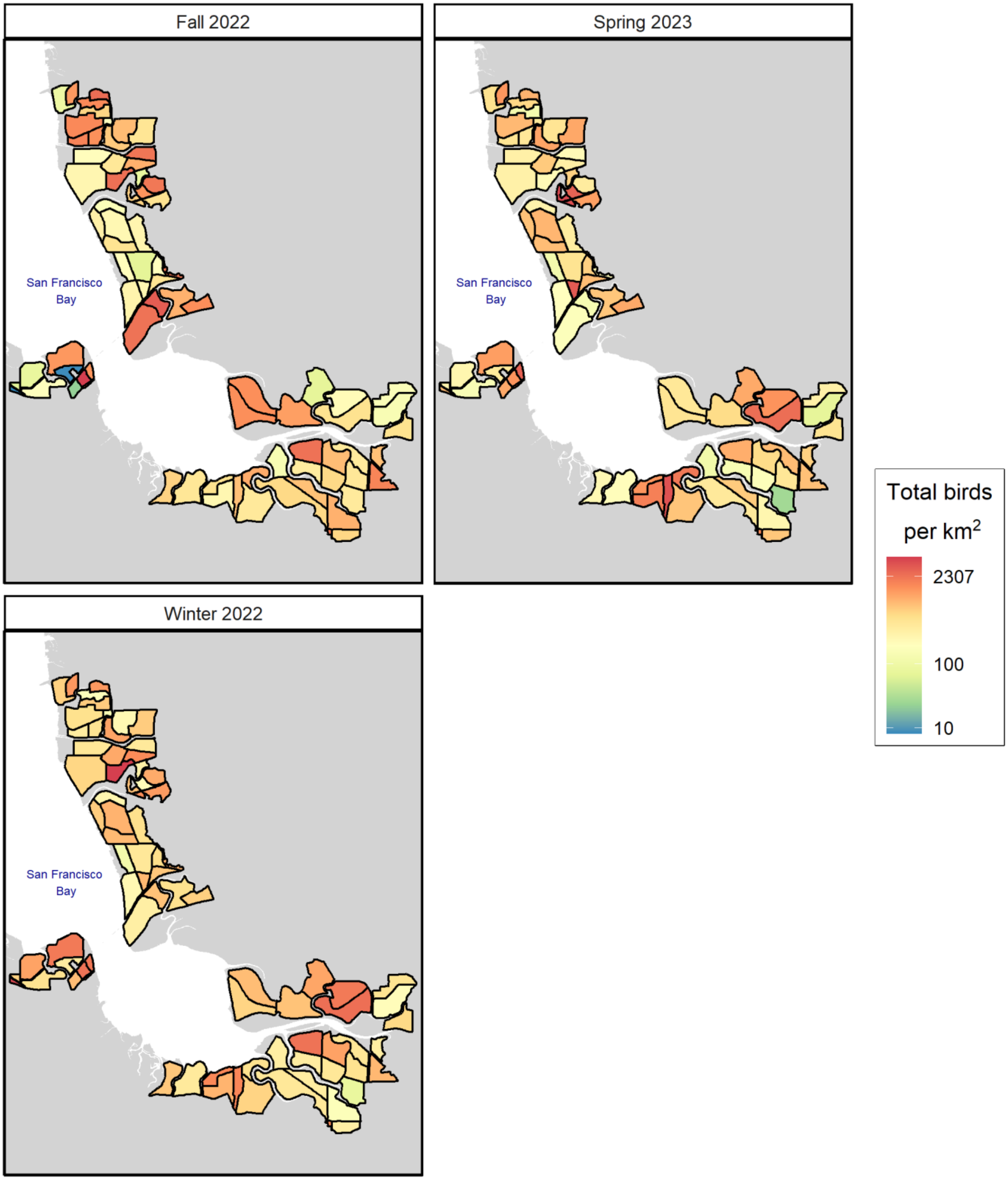

Figure 2. Density of total birds averaged across survey rounds by season, South San Francisco Bay, California; September 2022–May 2023. Dark grey ponds had no birds.

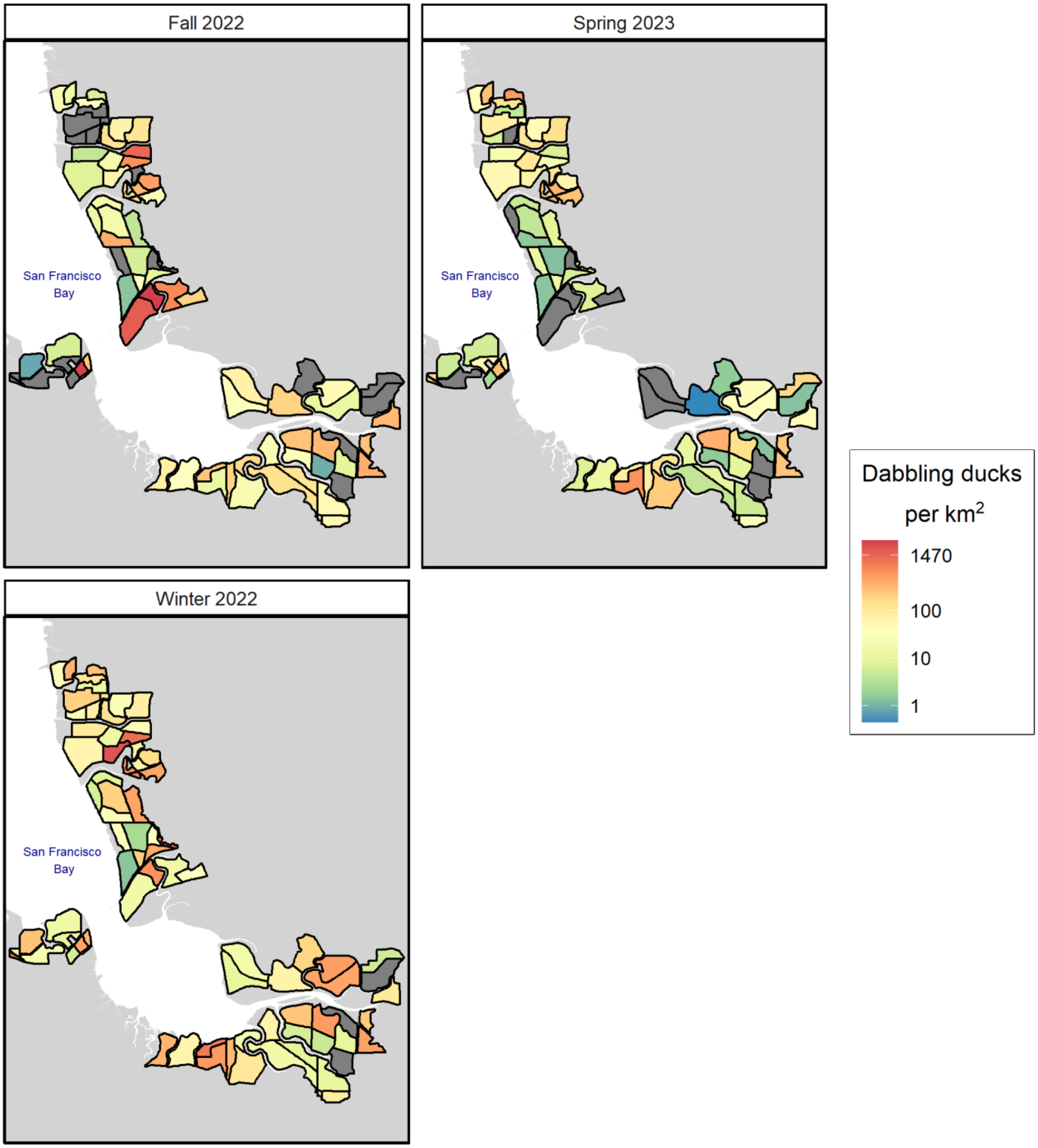

Figure 3. Density of dabbling ducks averaged across survey rounds by season, South San Francisco Bay, California; September 2022–May 2023. Dark grey ponds had no birds.

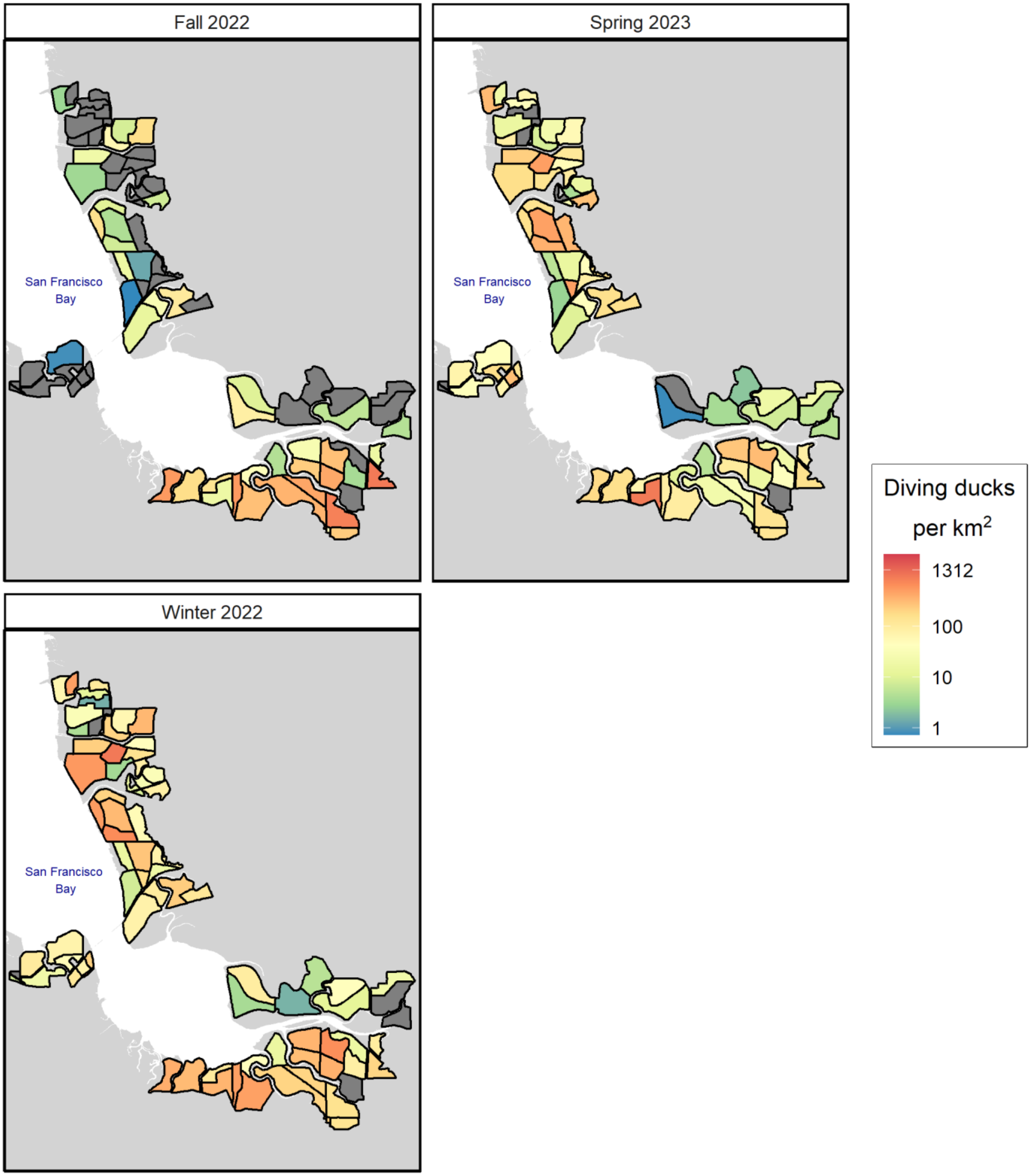

Figure 4. Density of diving ducks averaged across survey rounds by season, South San Francisco Bay, California; September 2022–May 2023. Dark grey ponds had no birds.

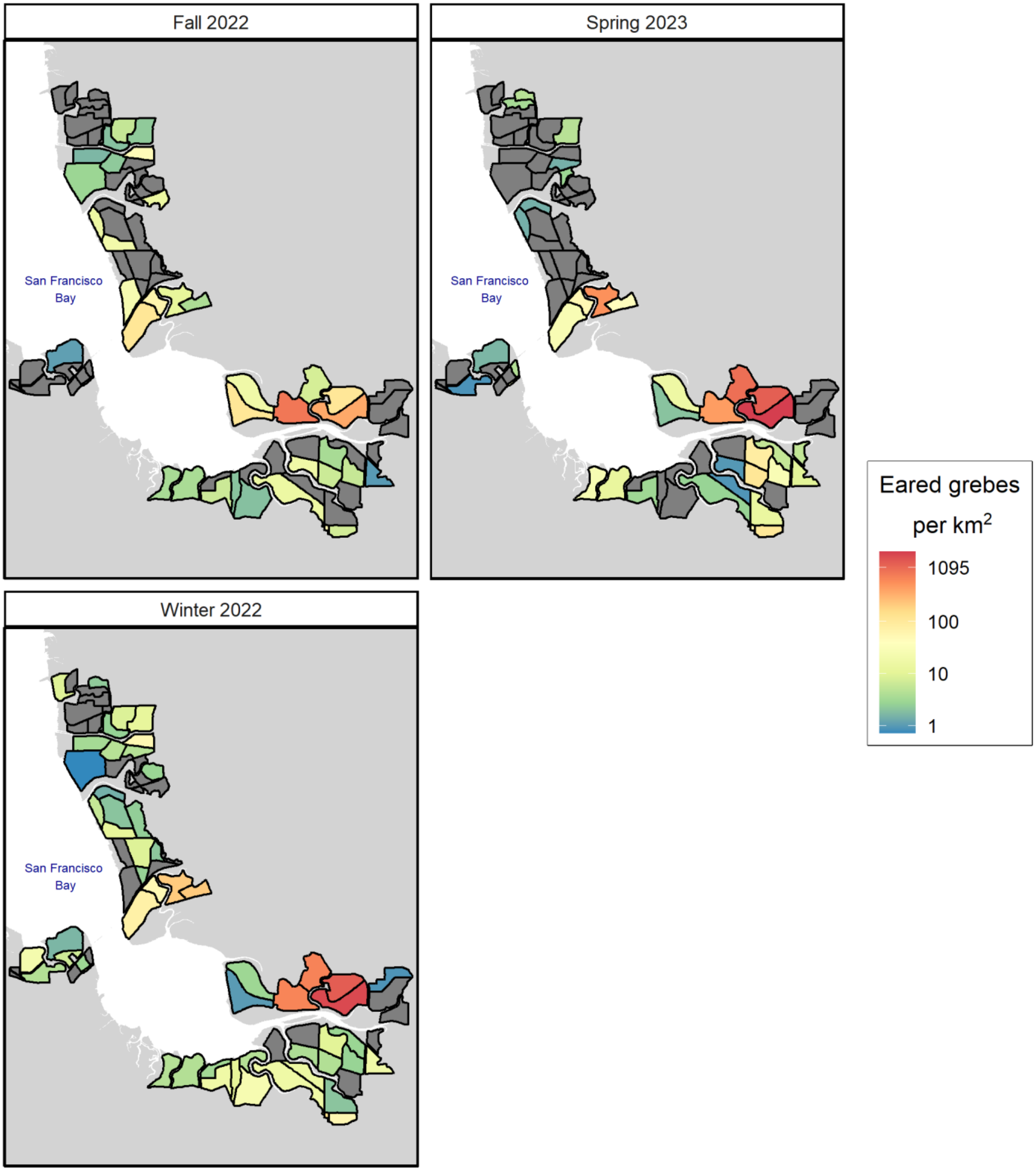

Figure 5. Density of eared grebes averaged across survey rounds by season, South San Francisco Bay, California; September 2022–May 2023. Dark grey ponds had no birds.

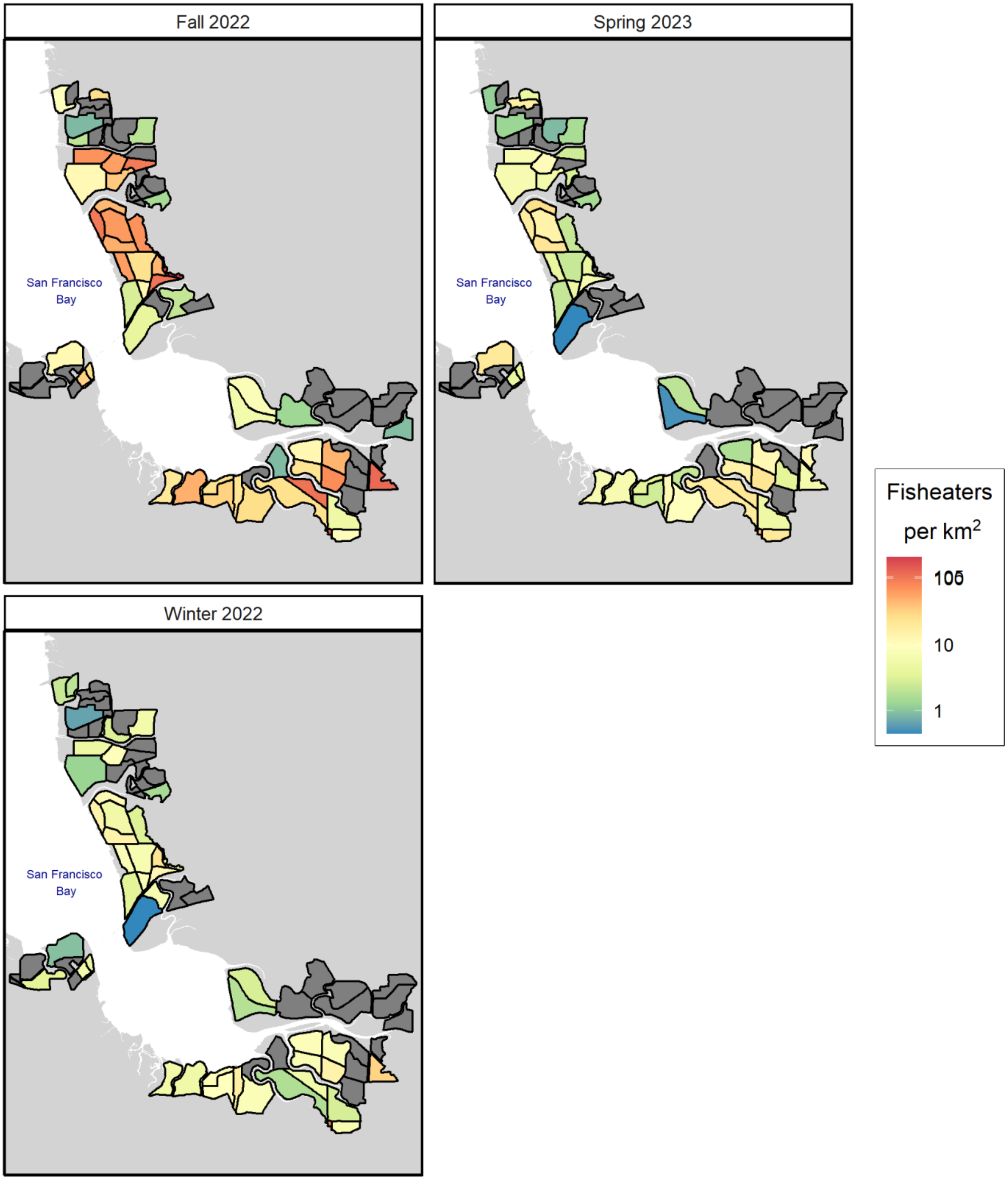

Figure 6. Density of fisheaters averaged across survey rounds by season, South San Francisco Bay, California; September 2022–May 2023. Dark grey ponds had no birds.

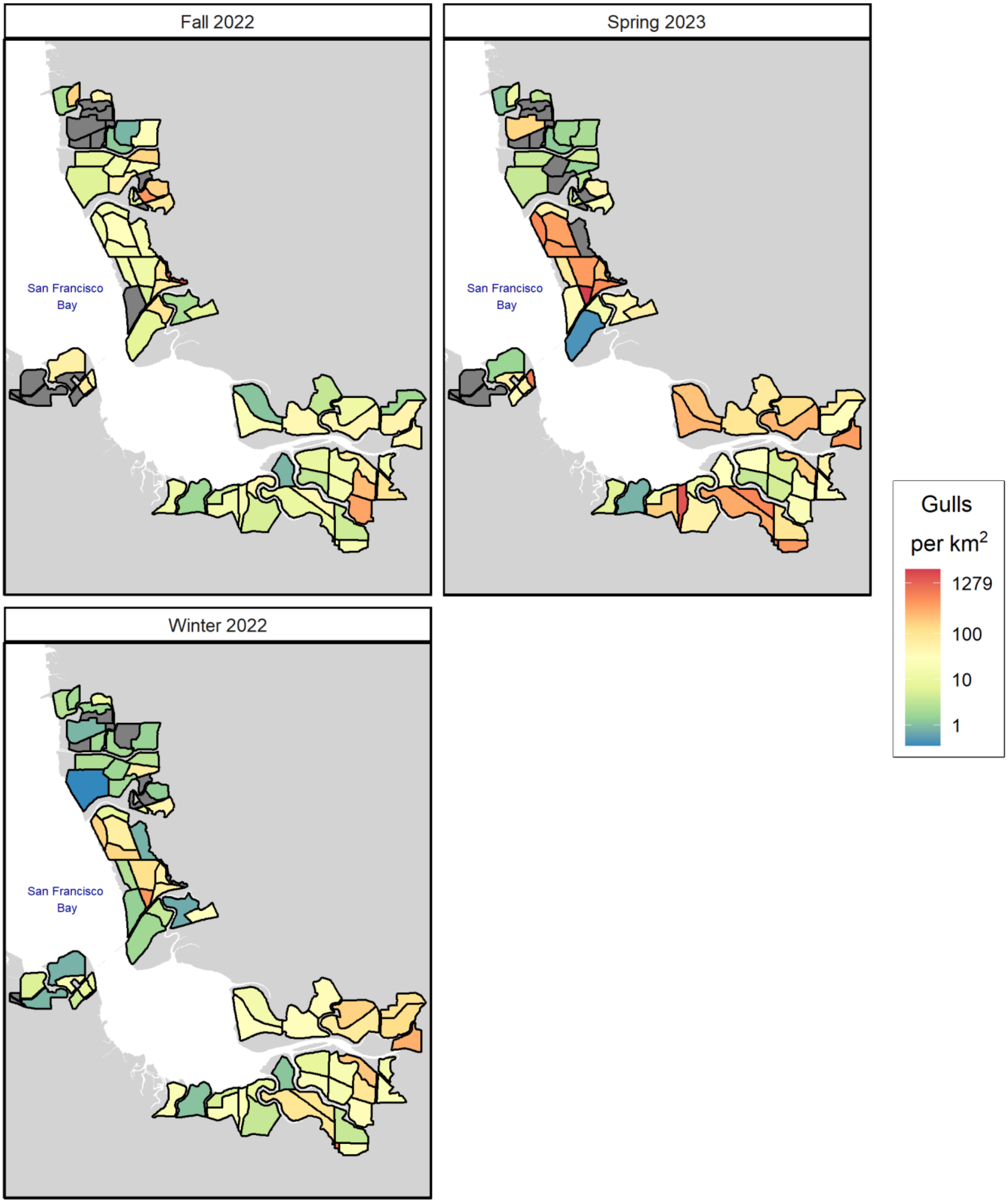

Figure 7. Density of gulls averaged across survey rounds by season, South San Francisco Bay, California; September 2022–May 2023. Dark grey ponds had no birds.

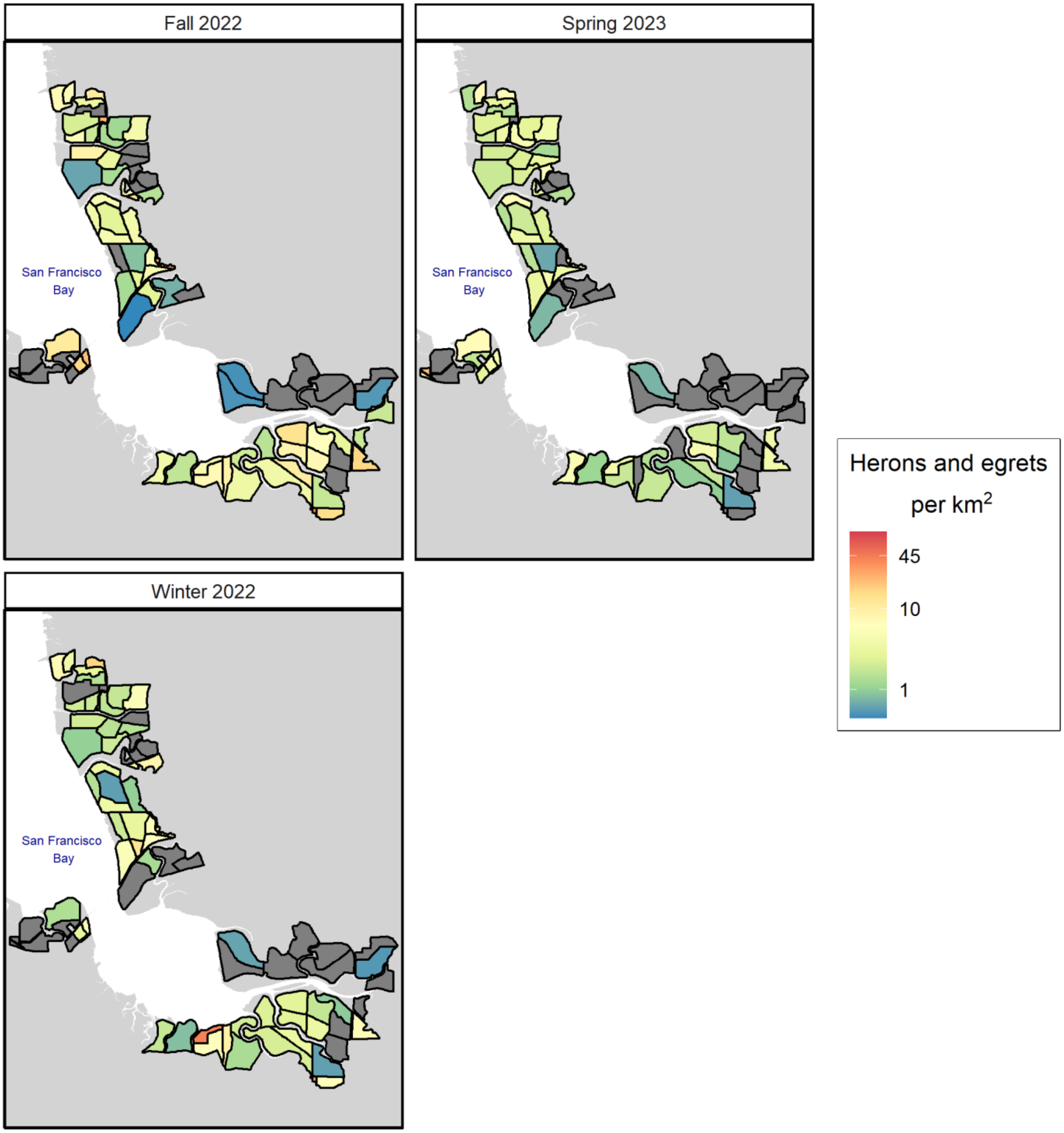

Figure 8. Density of herons and egrets averaged across survey rounds by season, South San Francisco Bay, California; September 2022–May 2023. Dark grey ponds had no birds.

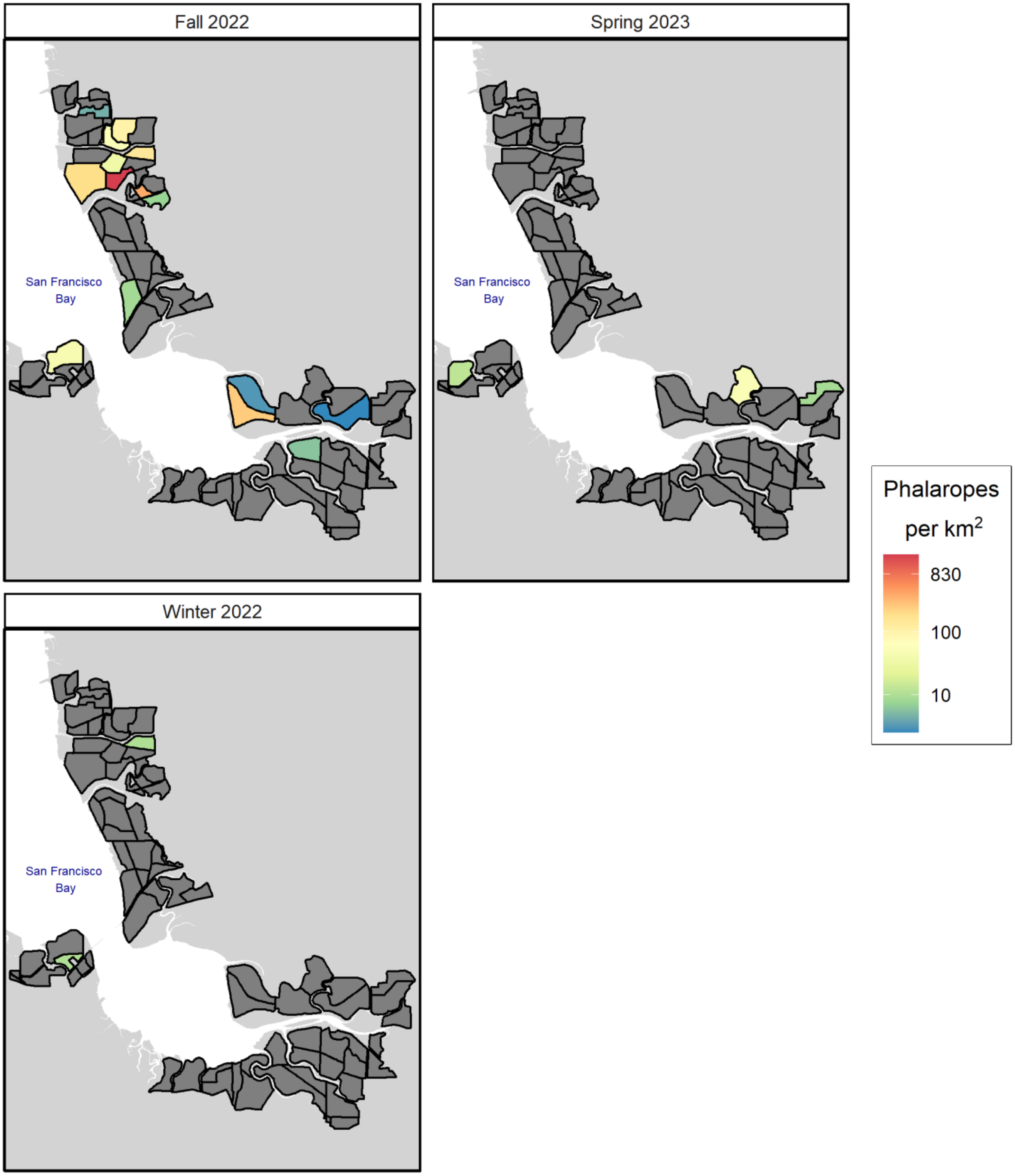

Figure 9. Density of phalaropes averaged across survey rounds by season, South San Francisco Bay, California; September 2022–May 2023. Dark grey ponds had no birds.

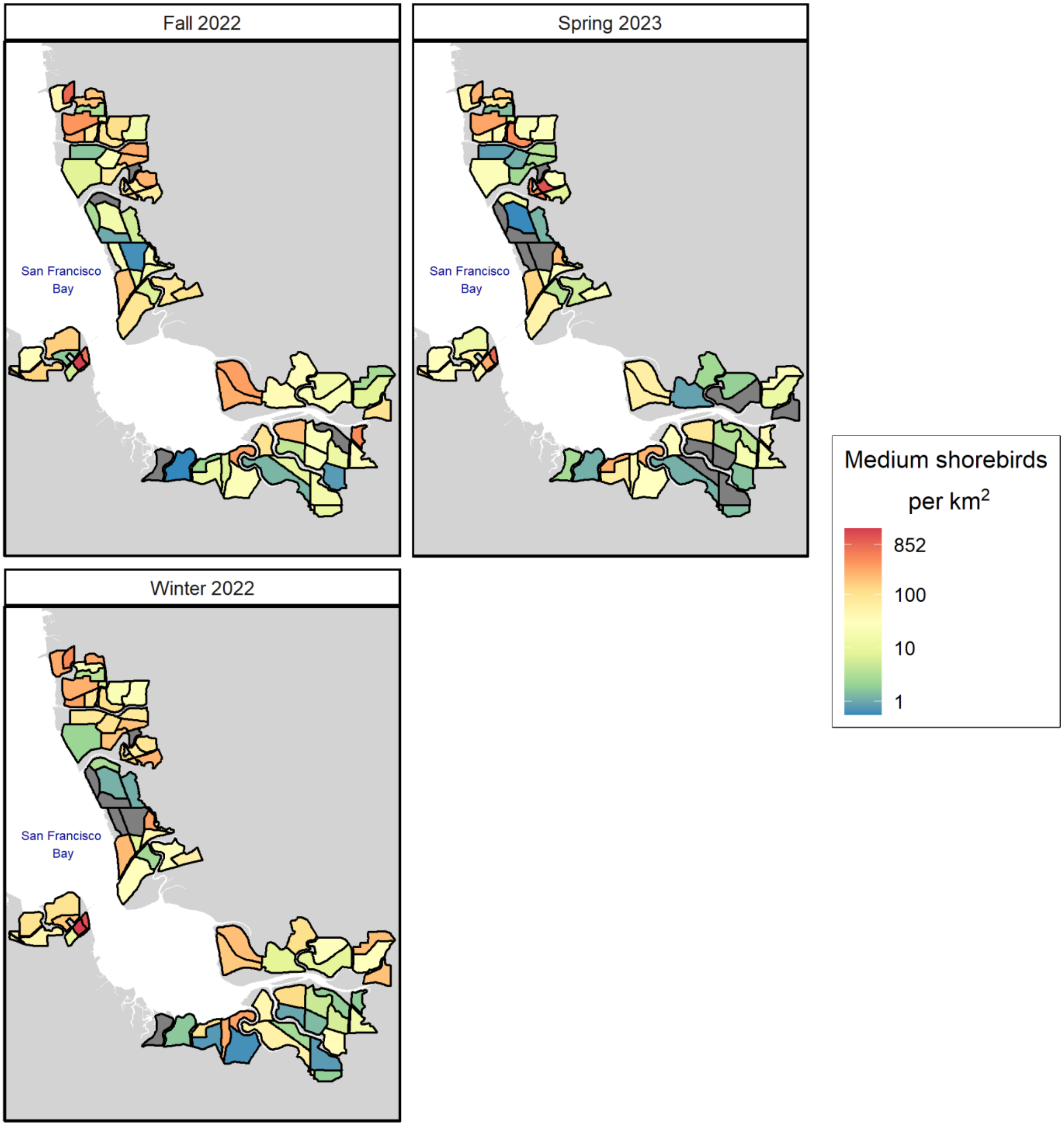

Figure 10. Density of medium shorebirds averaged across survey rounds by season, South San Francisco Bay, California; September 2022–May 2023. Dark grey ponds had no birds.

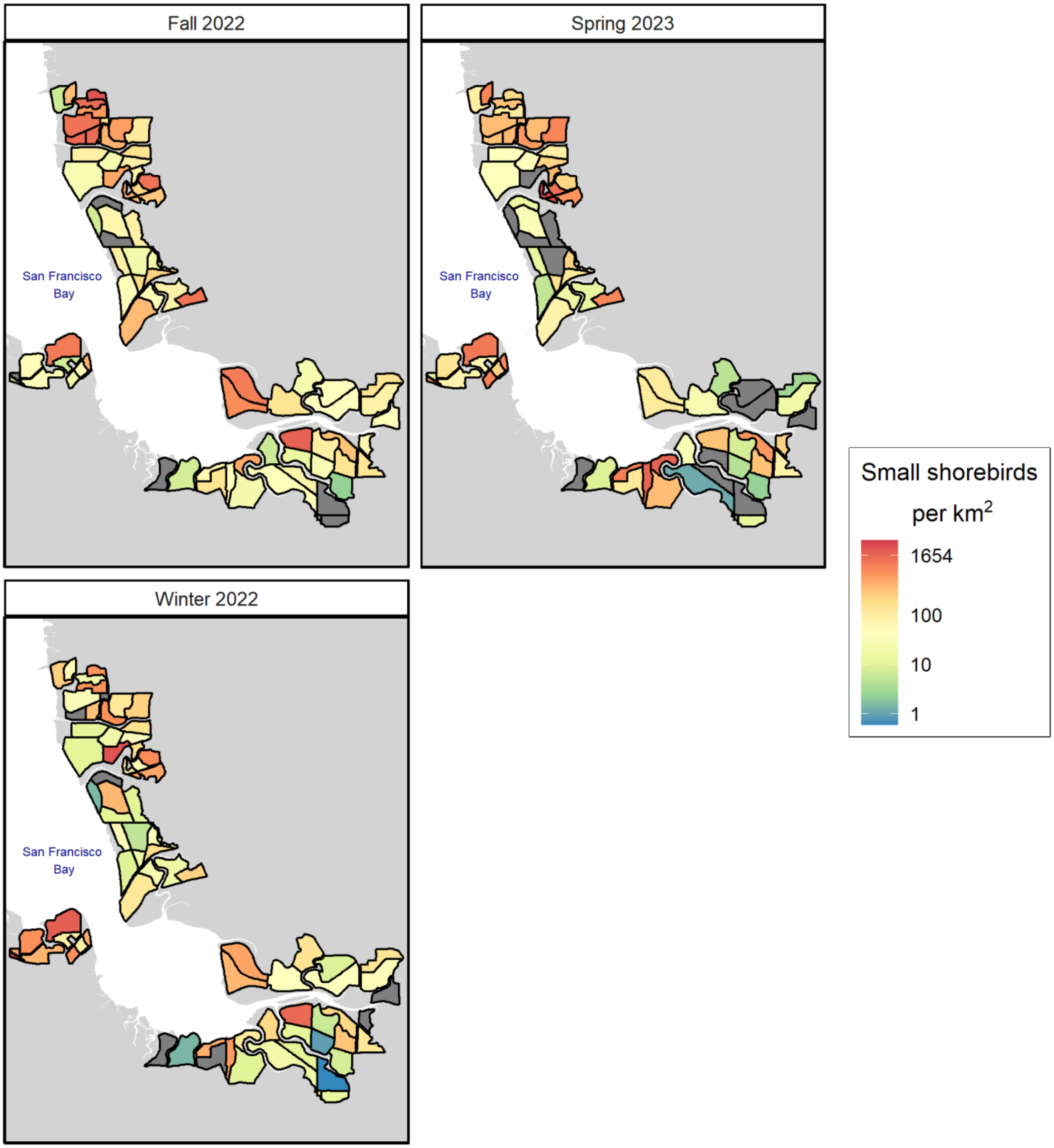

Figure 11. Density of small shorebirds averaged across survey rounds by season, South San Francisco Bay, California; September 2022–May 2023. Dark grey ponds had no birds.

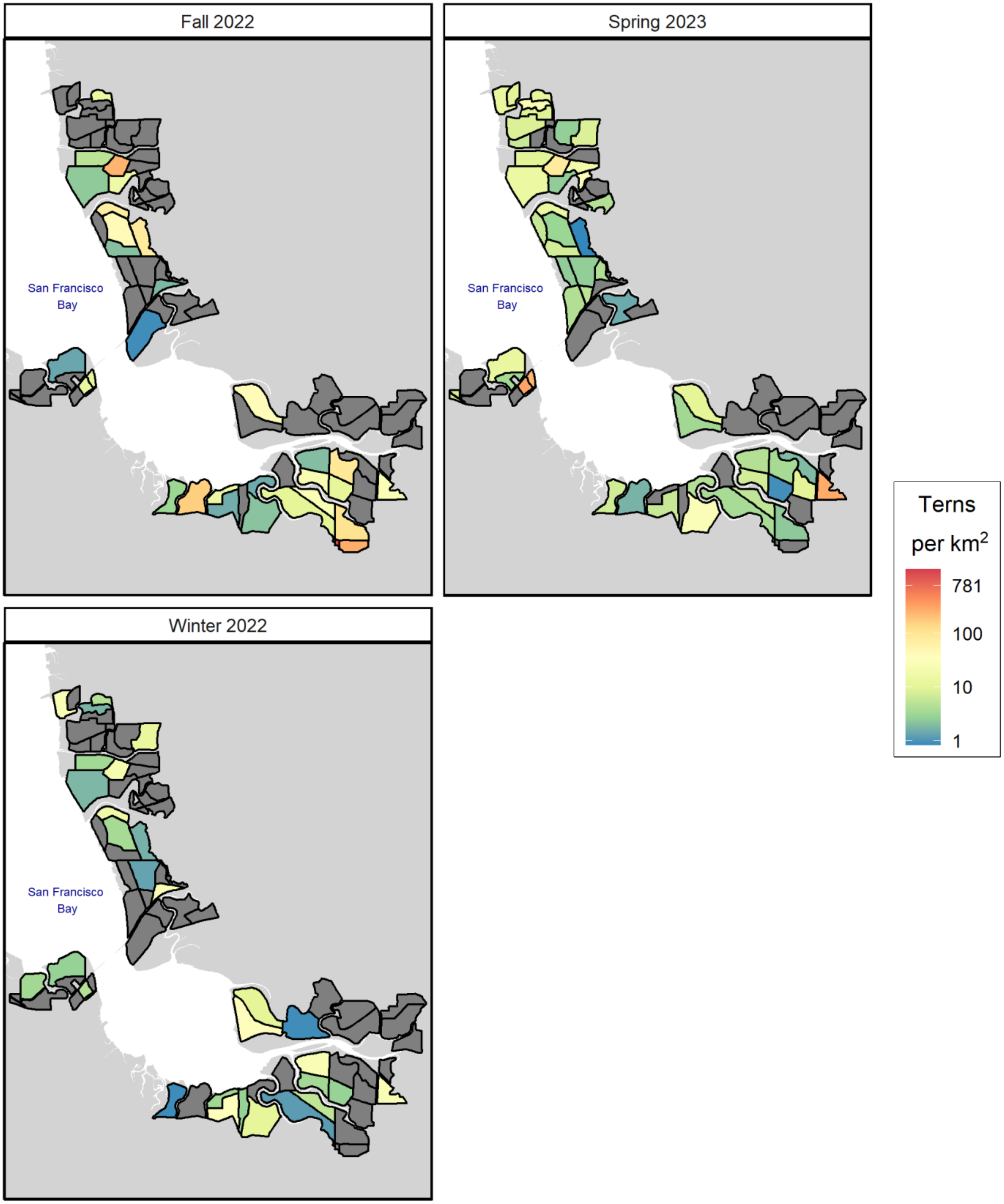

Figure 12. Density of terns averaged across survey rounds by season, South San Francisco Bay, California; September 2022–May 2023. Dark grey ponds had no birds.

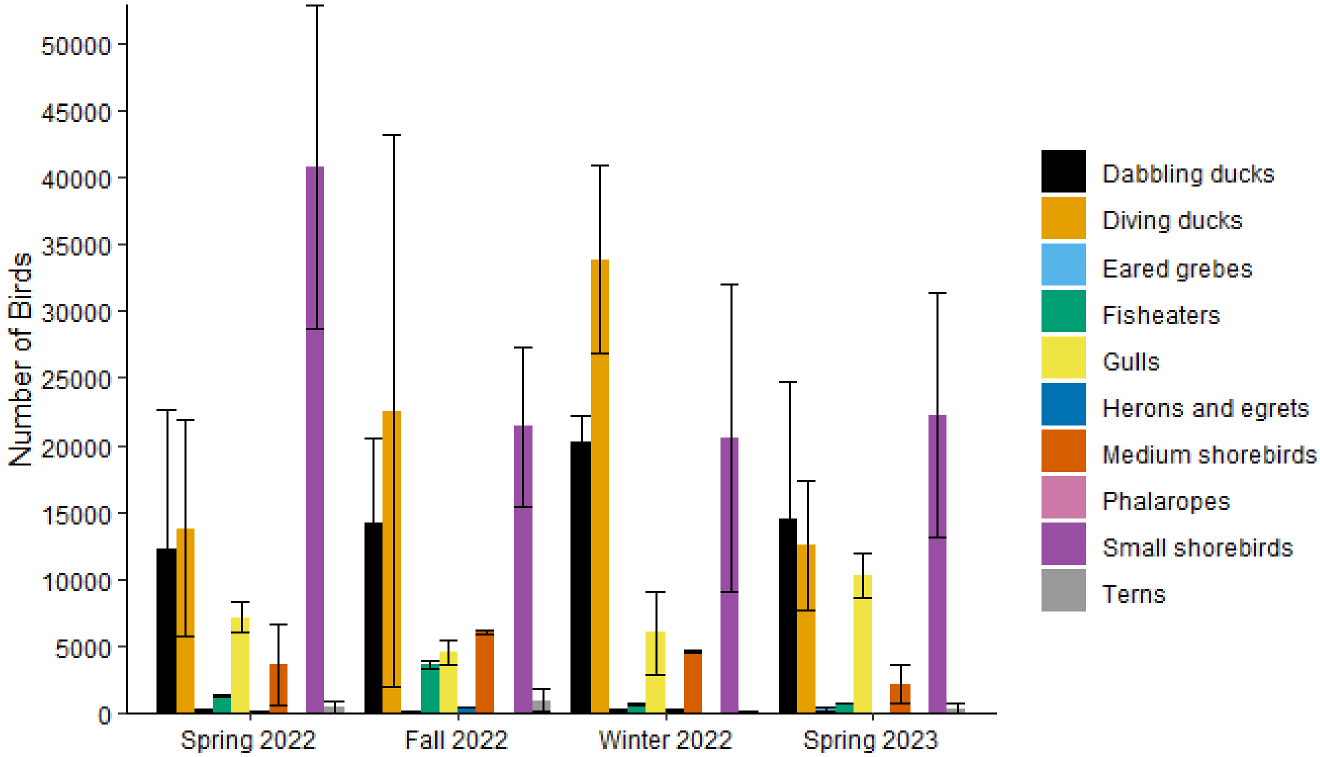

Figure 13. Avian abundance (mean number of bird sightings +/- 1 SE) by guild and by season at the Alviso complex, South San Francisco Bay, California; September 2022–May 2023. Scales on vertical axis are unique for each complex (Figure 13–Figure 18).

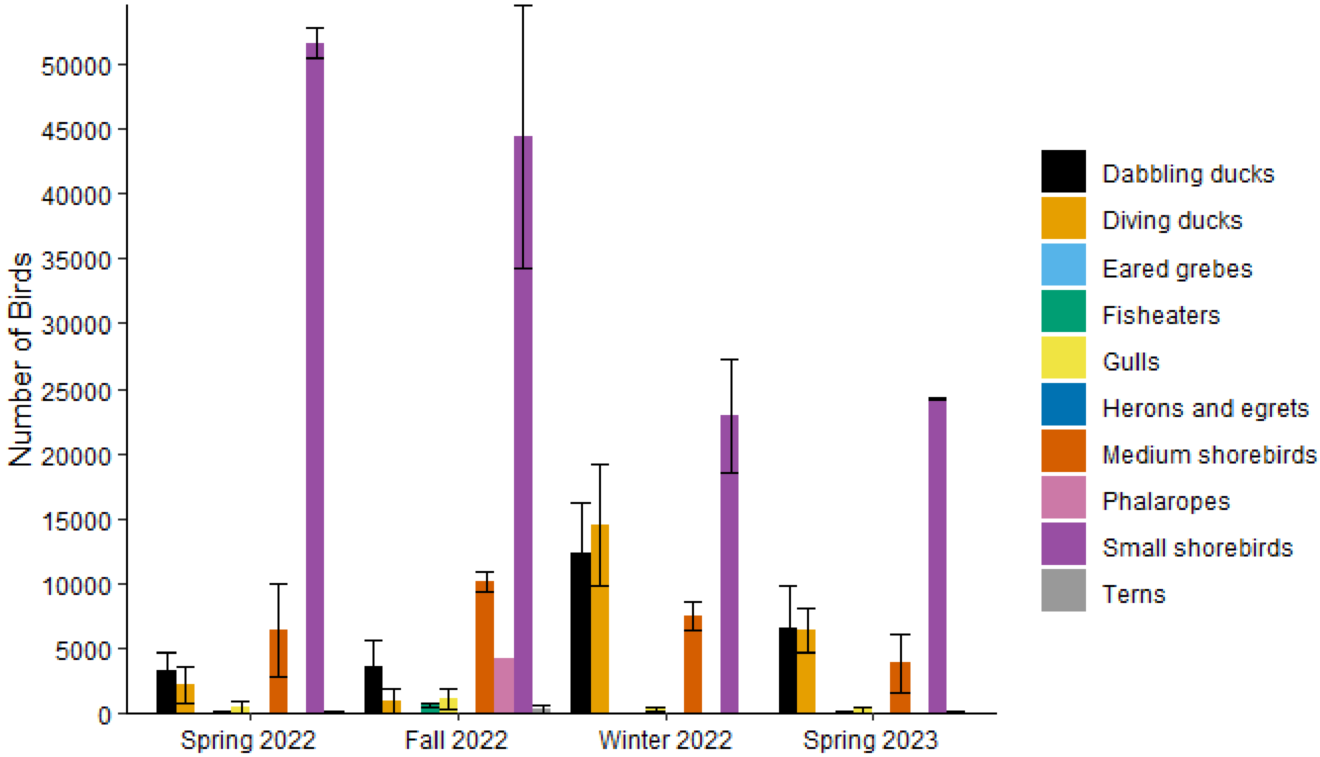

Figure 14. Avian abundance (mean number of bird sightings +/- 1 SE) by guild and by season at the Eden Landing complex, South San Francisco Bay, California; September 2022–May 2023. Scales on vertical axis are unique for each complex (Figure 13–Figure 18).

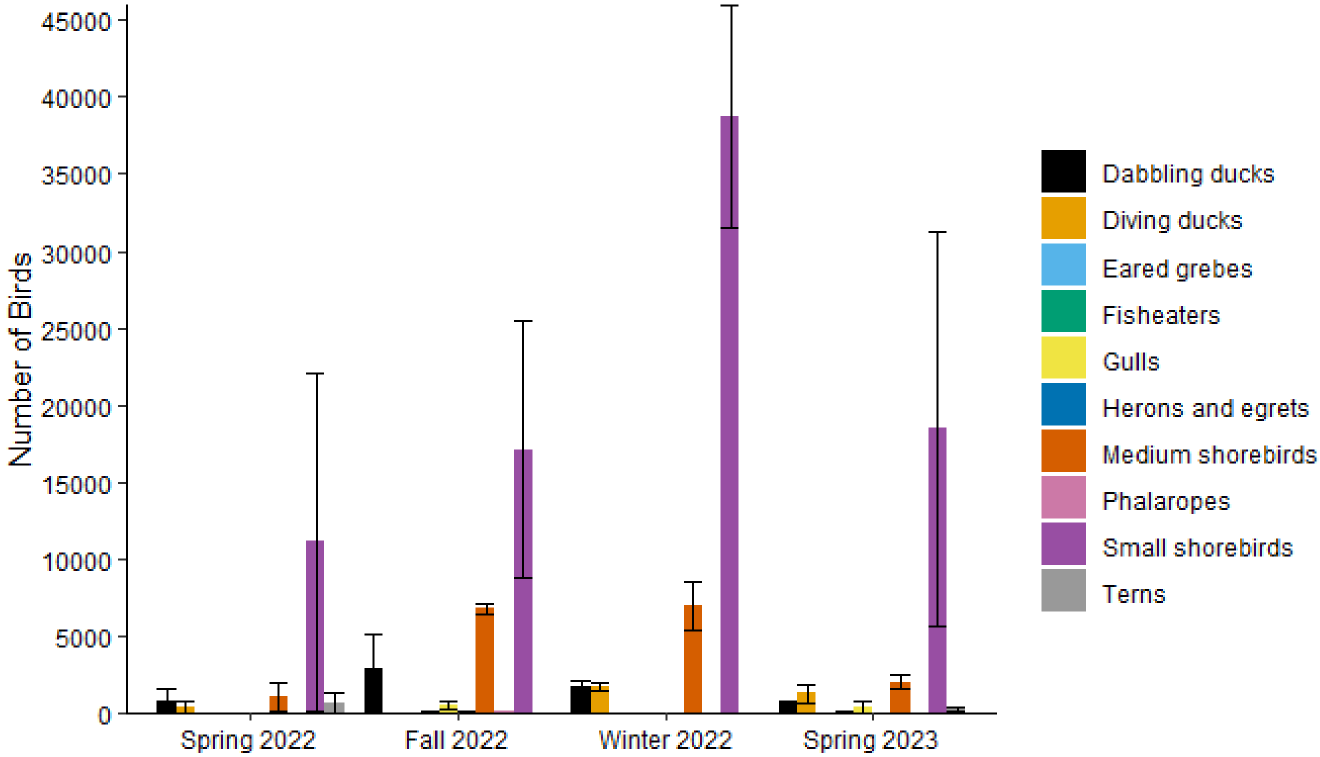

Figure 15. Avian abundance (mean number of bird sightings +/- 1 SE) by guild and by season at the Ravenswood complex, South San Francisco Bay, California; September 2022–May 2023. Scales on vertical axis are unique for each complex (Figure 13–Figure 18).

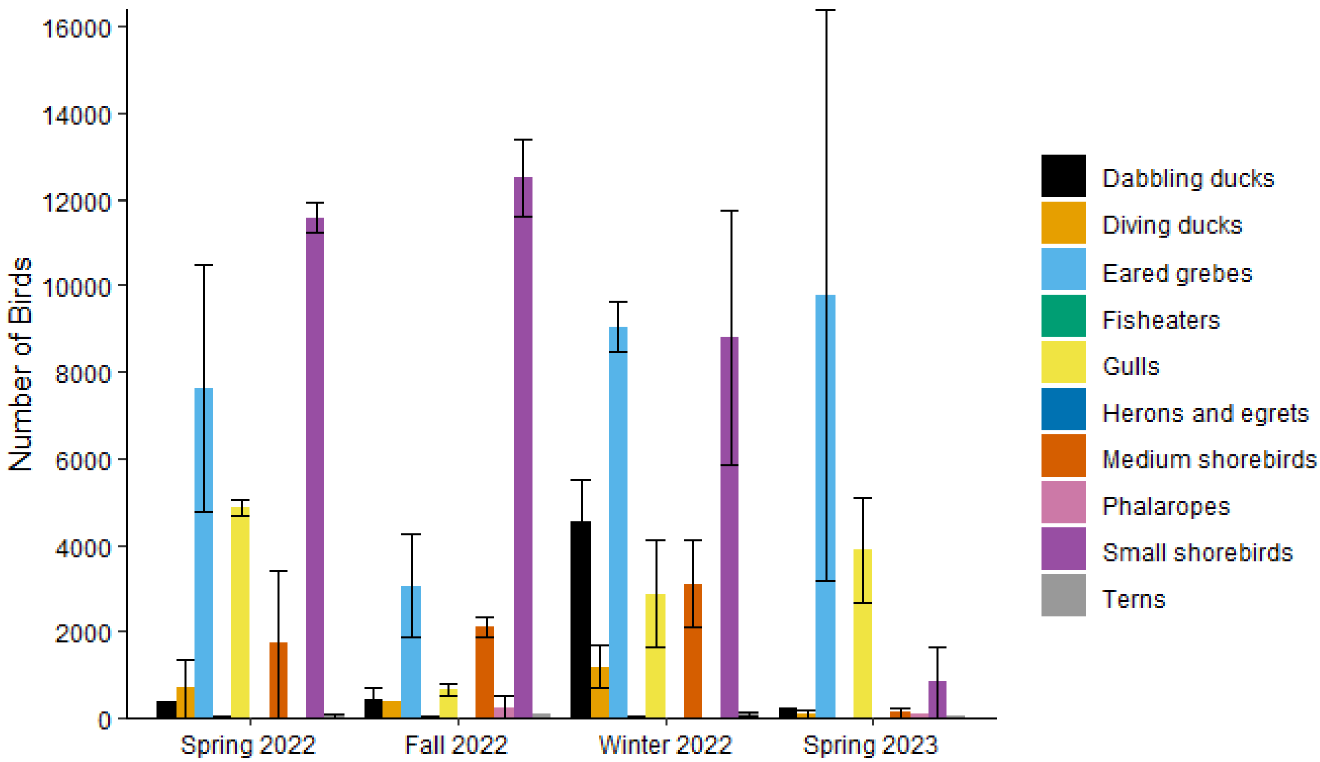

Figure 16. Avian abundance (mean number of bird sightings +/- 1 SE) by guild and by season at the Mowry complex, South San Francisco Bay, California; September 2022–May 2023. Scales on vertical axis are unique for each complex (Figure 13–Figure 18).

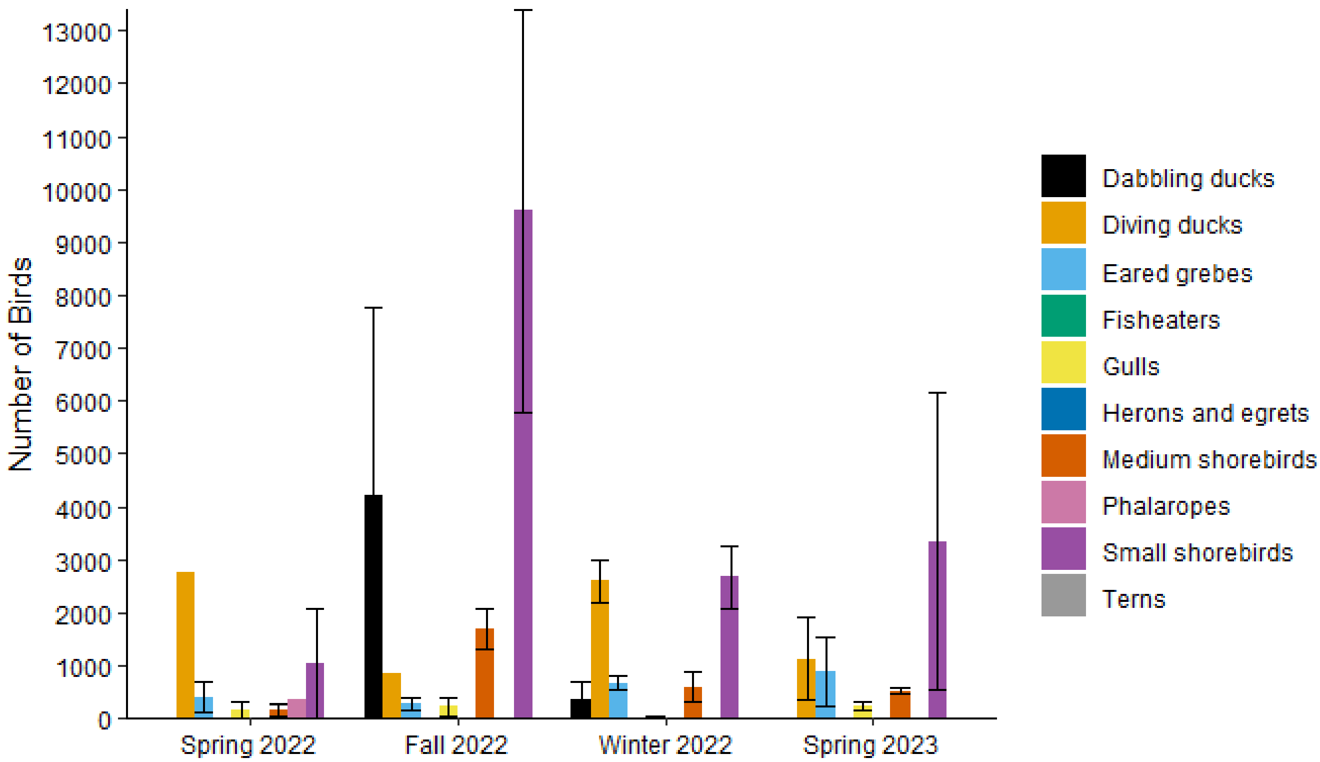

Figure 17. Avian abundance (mean number of bird sightings +/- 1 SE) by guild and by season at the Dumbarton complex, South San Francisco Bay, California; September 2022–May 2023. Scales on vertical axis are unique for each complex (Figure 13–Figure 18).

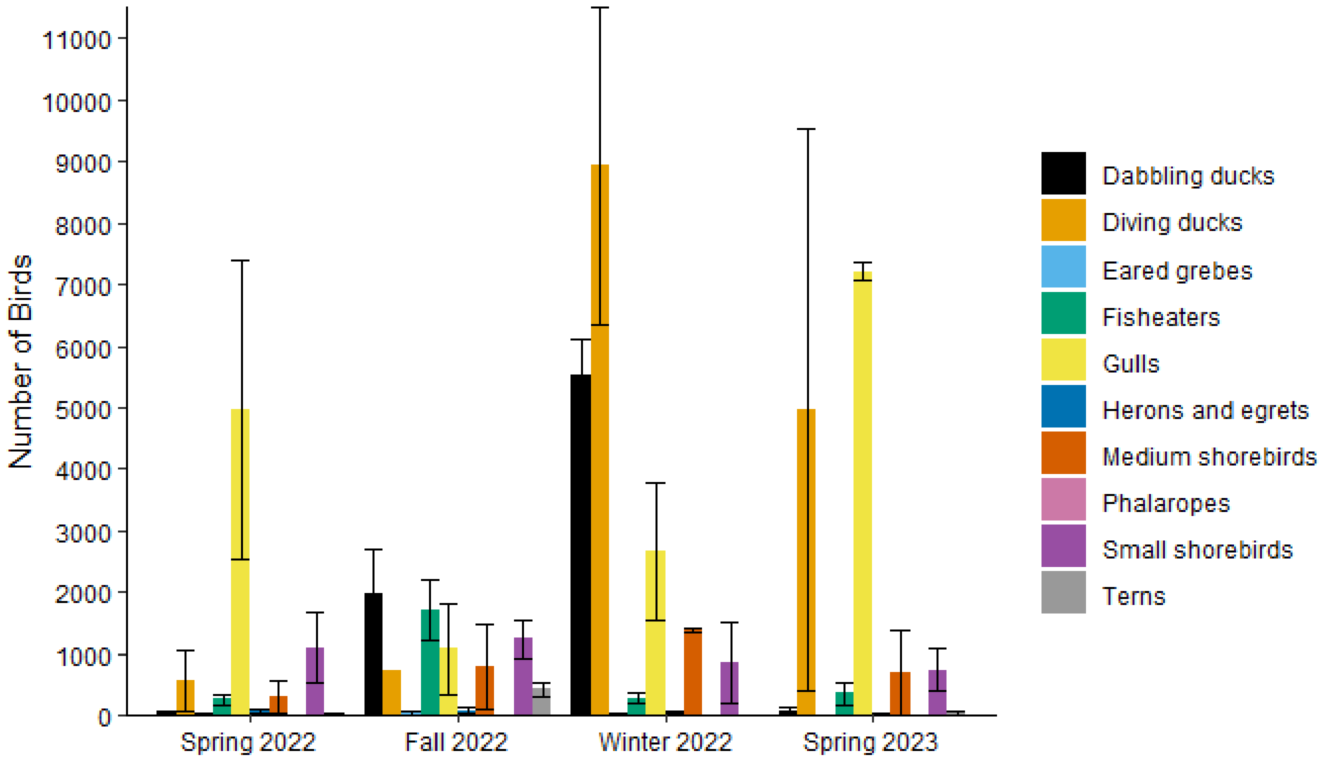

Figure 18. Avian abundance (mean number of bird sightings +/- 1 SE) by guild and by season at the Coyote Hills complex, South San Francisco Bay, California; September 2022–May 2023. Scales on vertical axis are unique for each complex (Figure 13–Figure 18).

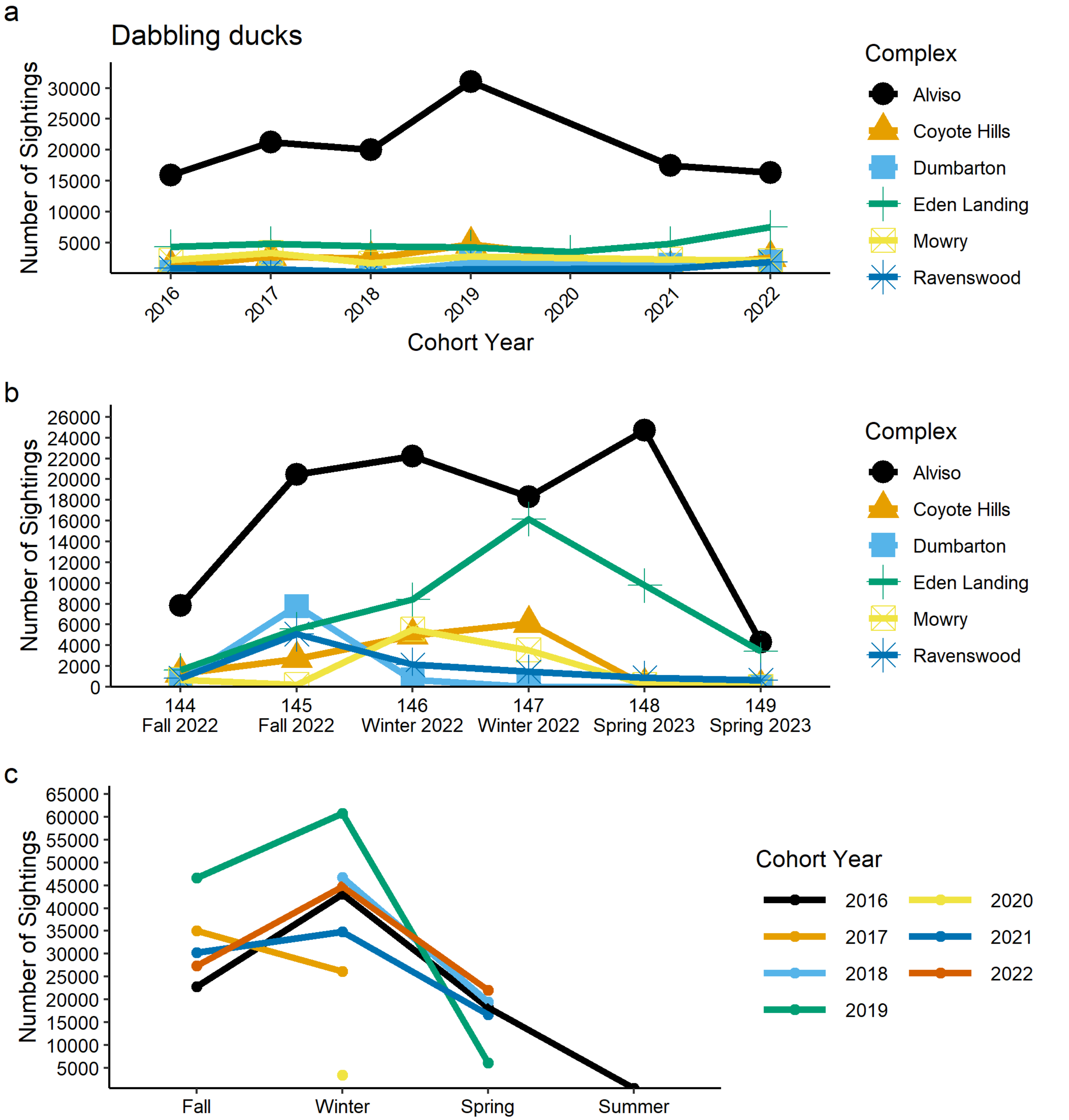

Figure 19. Abundance of dabbling ducks by (a) study year (September to August of the following year) for each complex (averaged across surveys), (b) survey period for each complex during the current report period (September 2022 – May 2023), and (c) season for each study year at all salt production ponds combined; South San Francisco Bay, California, Sept. 2005 – May 2023 (averaged across surveys). Study years 2019 and 2020 contain incomplete surveys rounds; see the Introduction for details.

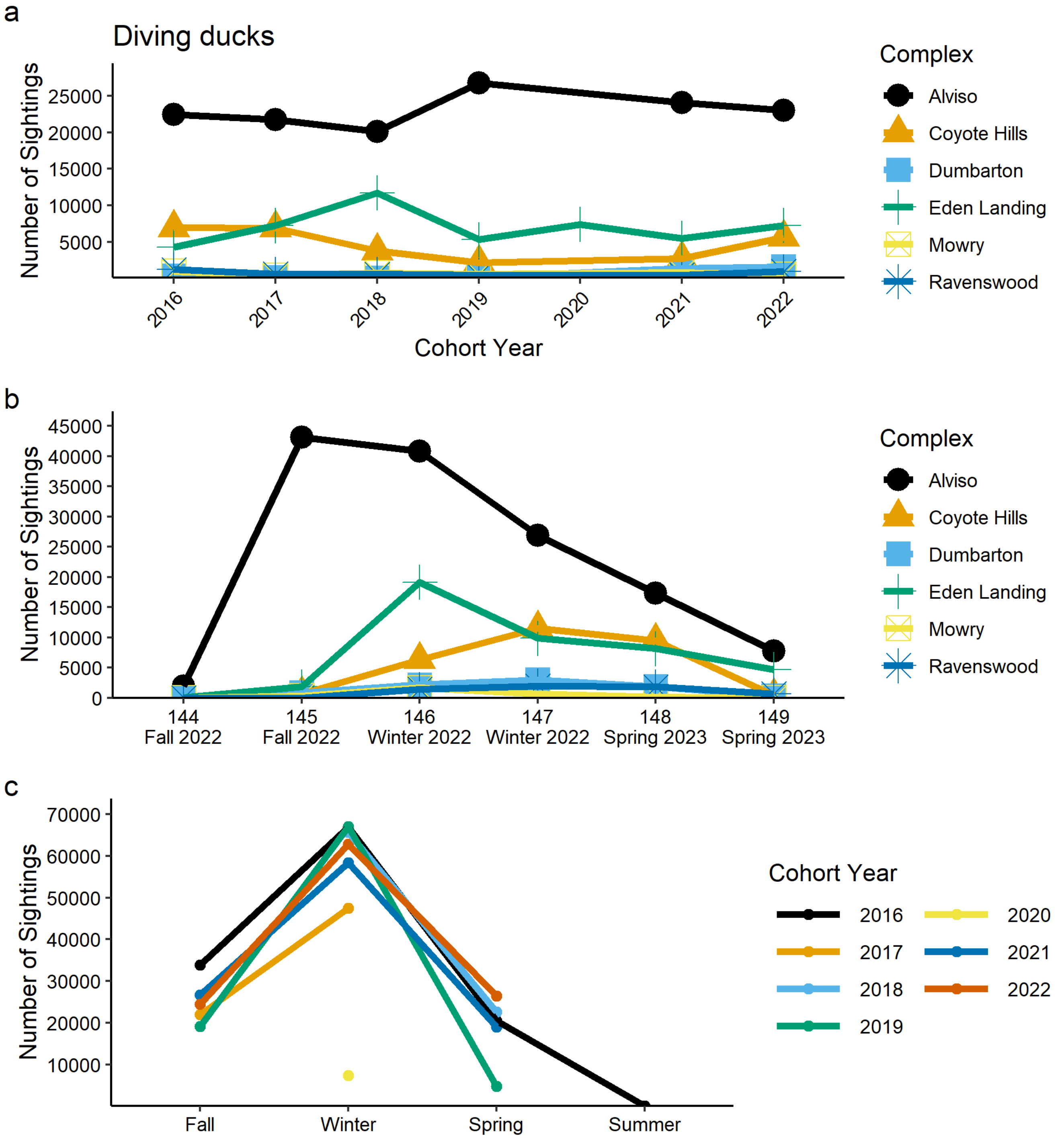

Figure 20. Abundance of diving ducks by (a) study year (September to August of the following year) for each complex (averaged across surveys), (b) survey period for each complex during the current report period (September 2022 – May 2023), and (c) season for each study year at all salt production ponds combined; South San Francisco Bay, California, Sept. 2005 – May 2023 (averaged across surveys). Study years 2019 and 2020 contain incomplete surveys rounds; see the Introduction for details.

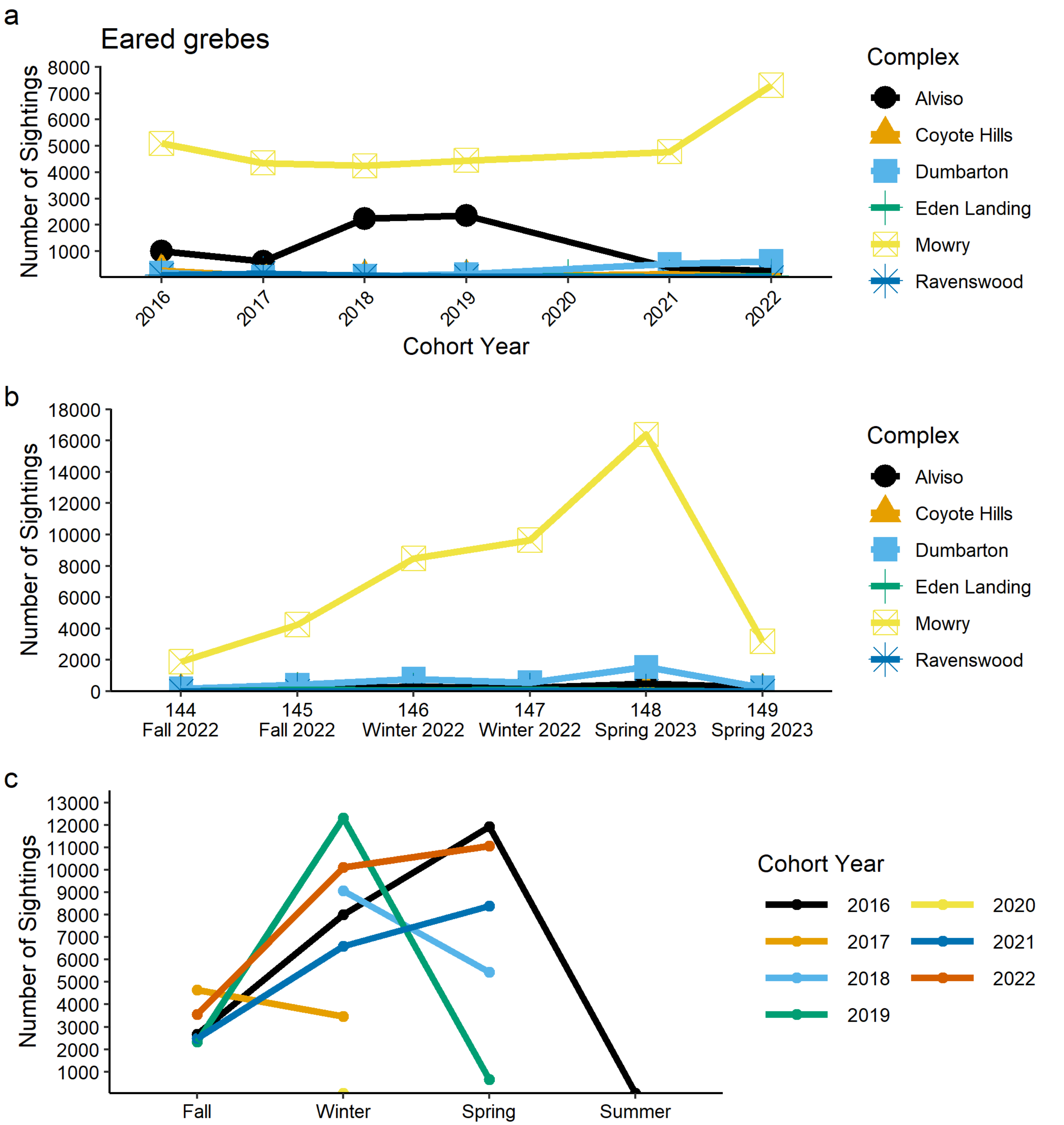

Figure 21. Abundance of eared grebes by (a) study year (September to August of the following year) for each complex (averaged across surveys), (b) survey period for each complex during the current report period (September 2022 – May 2023), and (c) season for each study year at all salt production ponds combined; South San Francisco Bay, California, Sept. 2005 – May 2023 (averaged across surveys). Study years 2019 and 2020 contain incomplete surveys rounds; see the Introduction for details.

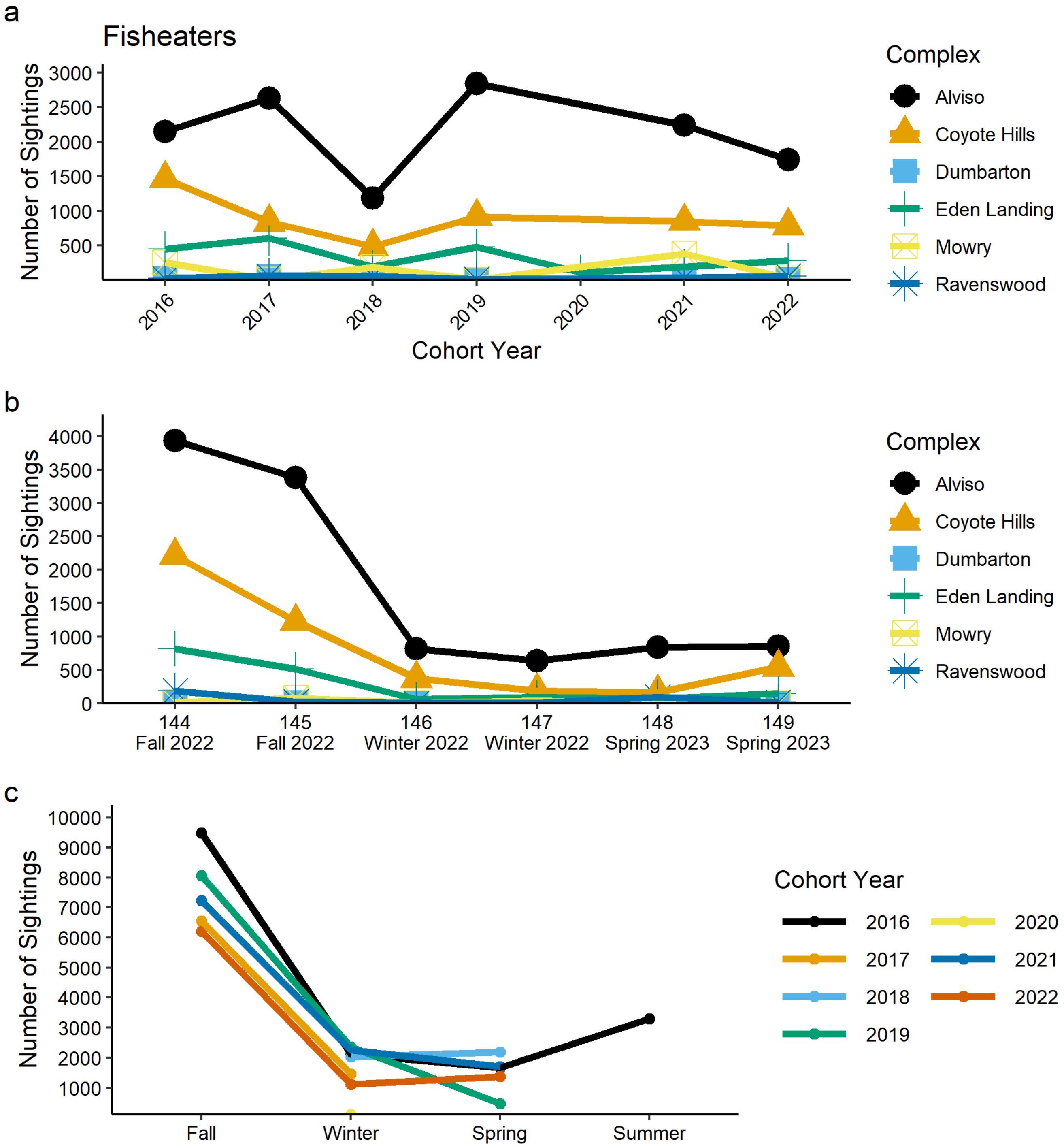

Figure 22. Abundance of fisheaters by (a) study year (September to August of the following year) for each complex (averaged across surveys), (b) survey period for each complex during the current report period (September 2022 – May 2023), and (c) season for each study year at all salt production ponds combined; South San Francisco Bay, California, Sept. 2005 – May 2023 (averaged across surveys). Study years 2019 and 2020 contain incomplete surveys rounds; see the Introduction for details.

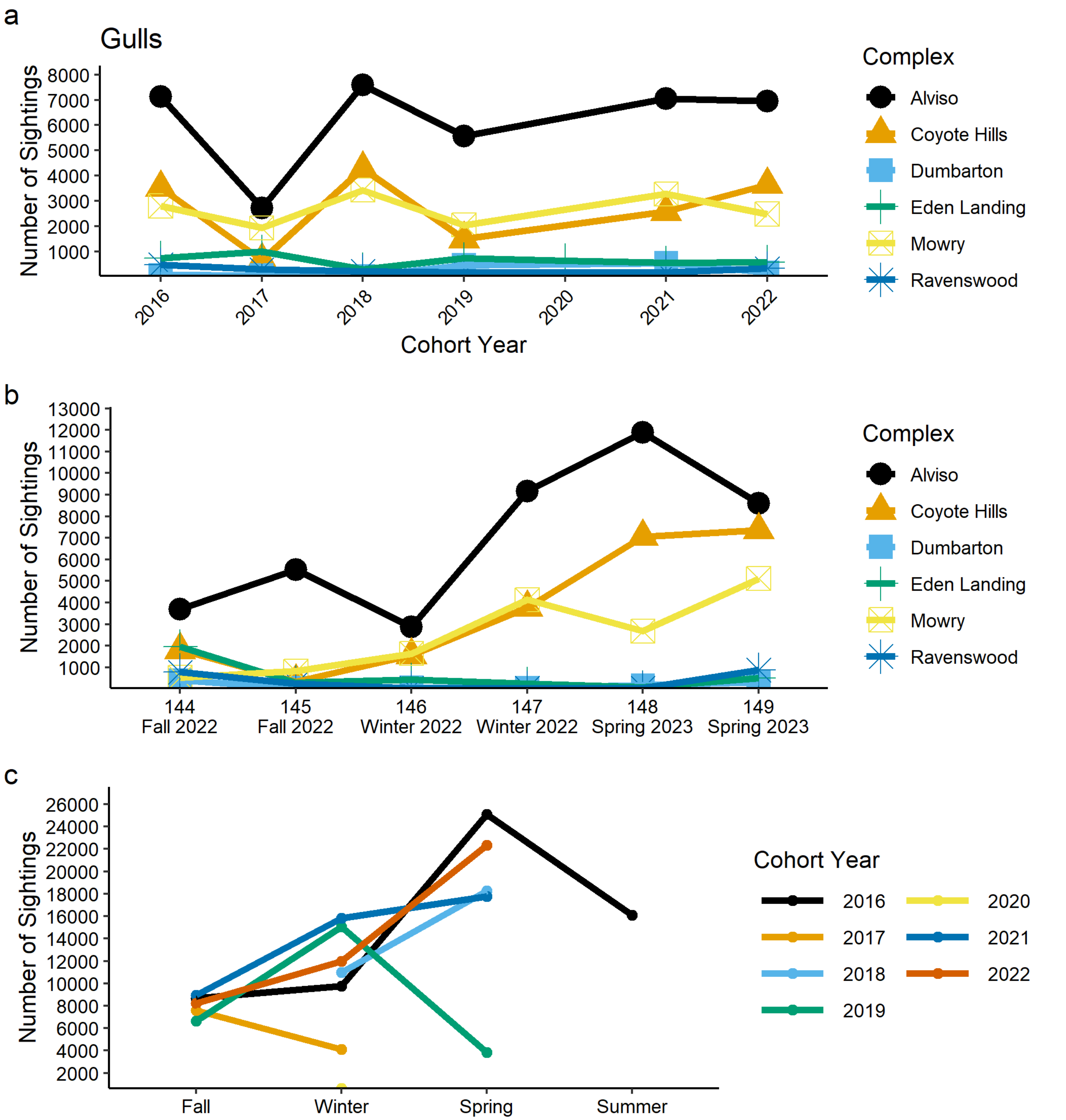

Figure 23. Abundance of gulls by (a) study year (September to August of the following year) for each complex (averaged across surveys), (b) survey period for each complex during the current report period (September 2022 – May 2023), and (c) season for each study year at all salt production ponds combined; South San Francisco Bay, California, Sept. 2005 – May 2023 (averaged across surveys). Study years 2019 and 2020 contain incomplete surveys rounds; see the Introduction for details.

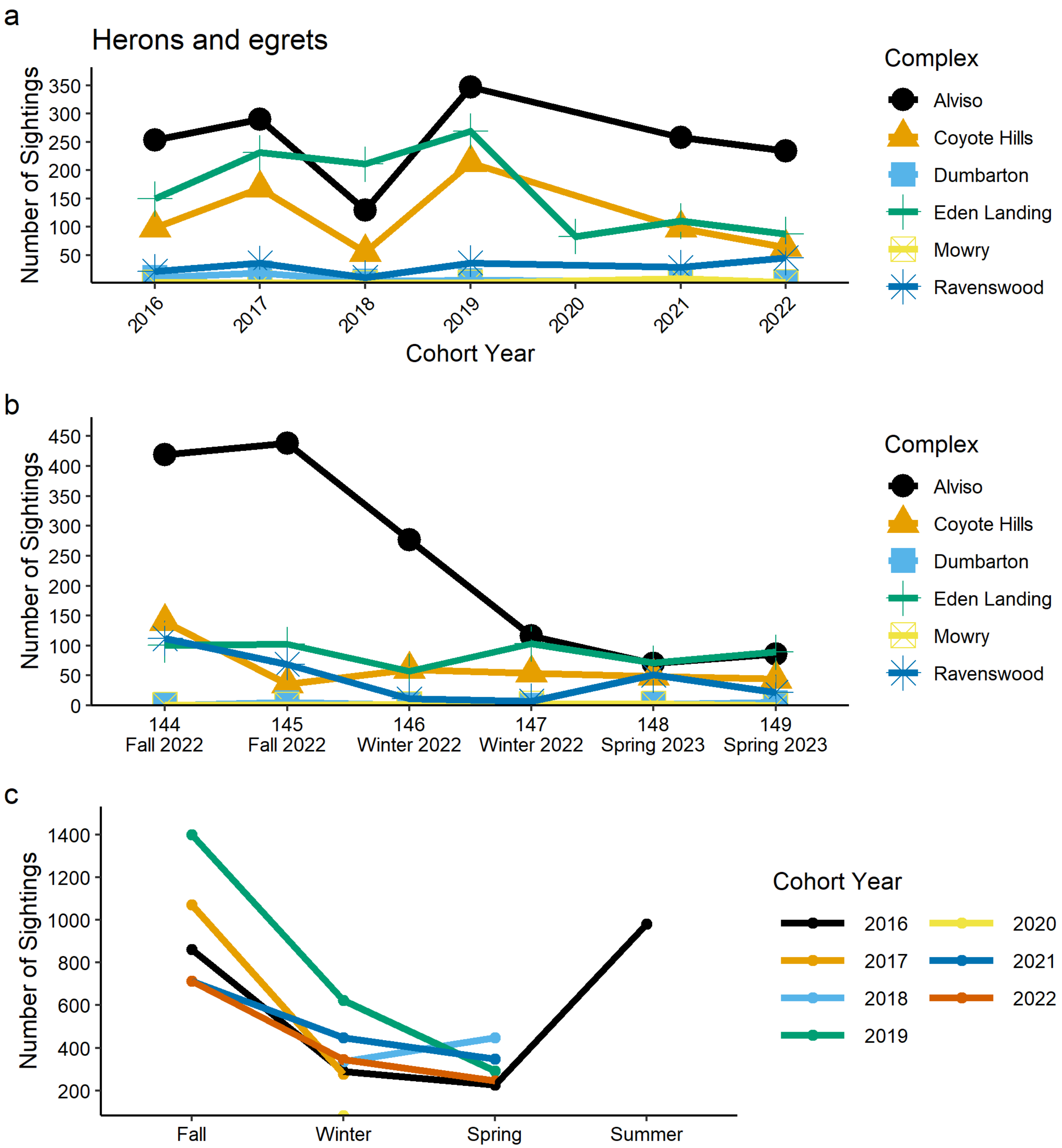

Figure 24. Abundance of herons and egrets by (a) study year (September to August of the following year) for each complex (averaged across surveys), (b) survey period for each complex during the current report period (September 2022 – May 2023), and (c) season for each study year at all salt production ponds combined; South San Francisco Bay, California, Sept. 2005 – May 2023 (averaged across surveys). Study years 2019 and 2020 contain incomplete surveys rounds; see the Introduction for details.

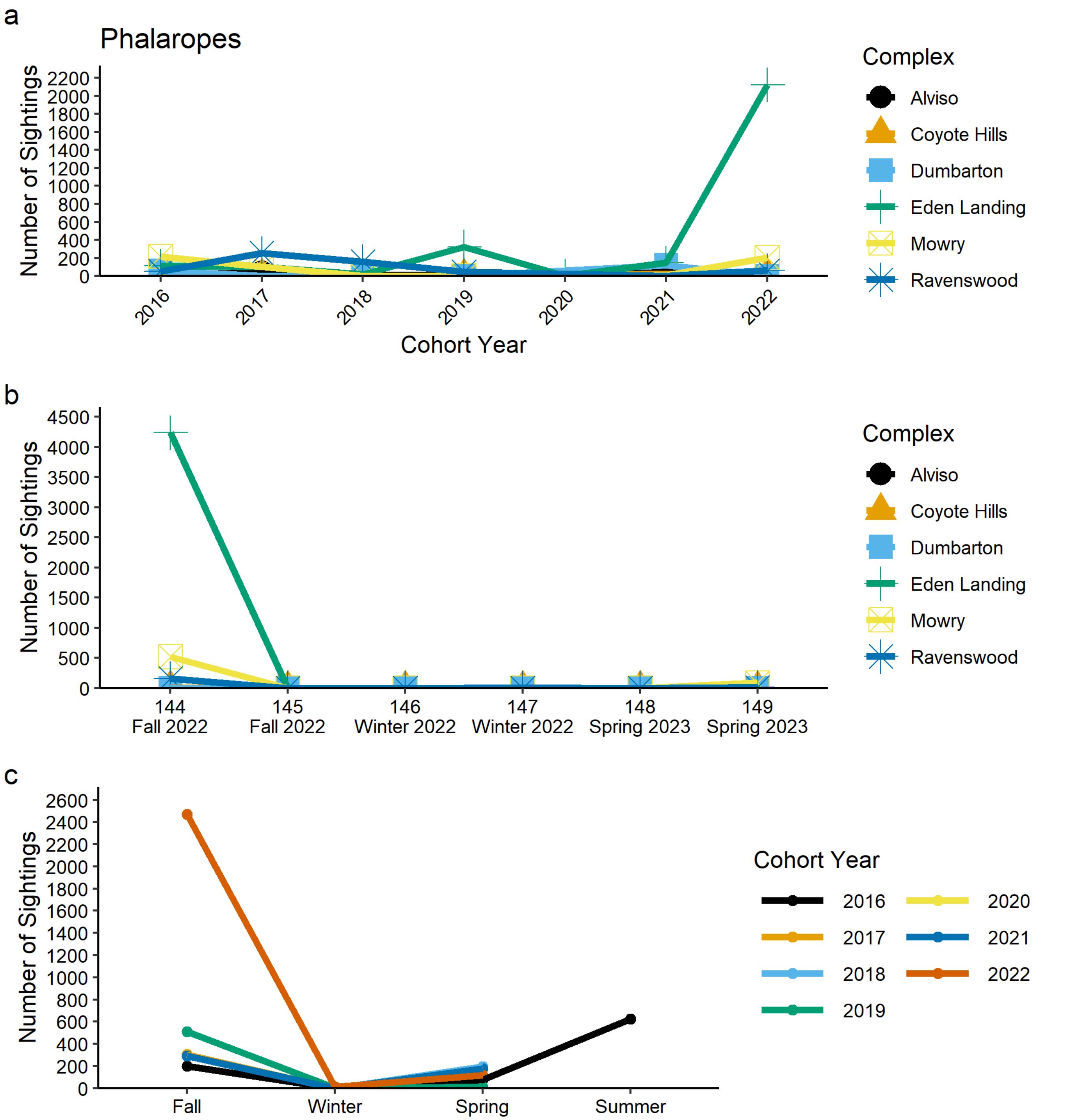

Figure 25. Abundance of phalaropes by (a) study year (September to August of the following year) for each complex (averaged across surveys), (b) survey period for each complex during the current report period (September 2022 – May 2023), and (c) season for each study year at all salt production ponds combined; South San Francisco Bay, California, Sept. 2005 – May 2023 (averaged across surveys). Study years 2019 and 2020 contain incomplete surveys rounds; see the Introduction for details.

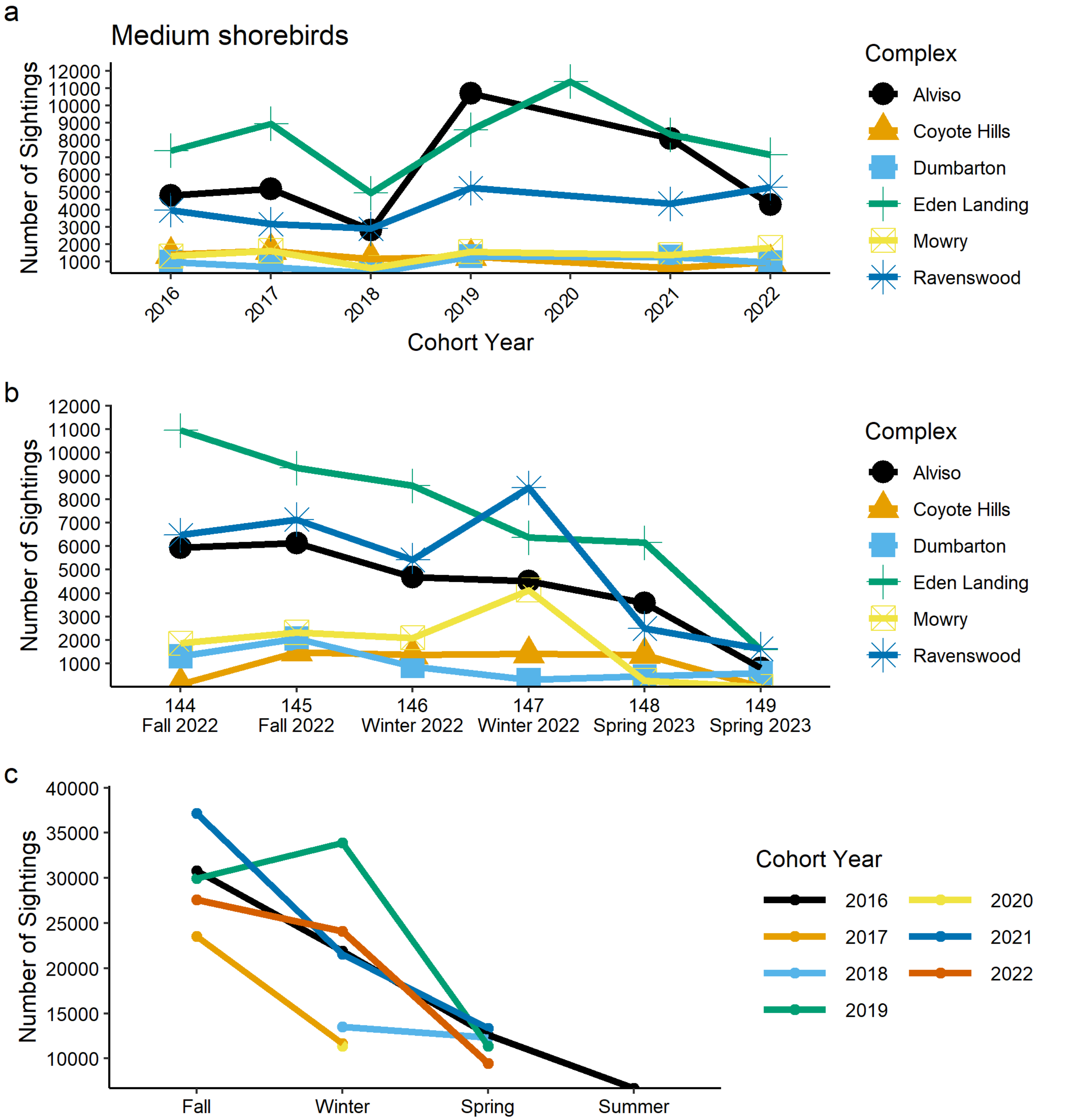

Figure 26. Abundance of medium shorebirds by (a) study year (September to August of the following year) for each complex (averaged across surveys), (b) survey period for each complex during the current report period (September 2022 – May 2023), and (c) season for each study year at all salt production ponds combined; South San Francisco Bay, California, Sept. 2005 – May 2023 (averaged across surveys). Study years 2019 and 2020 contain incomplete surveys rounds; see the Introduction for details.

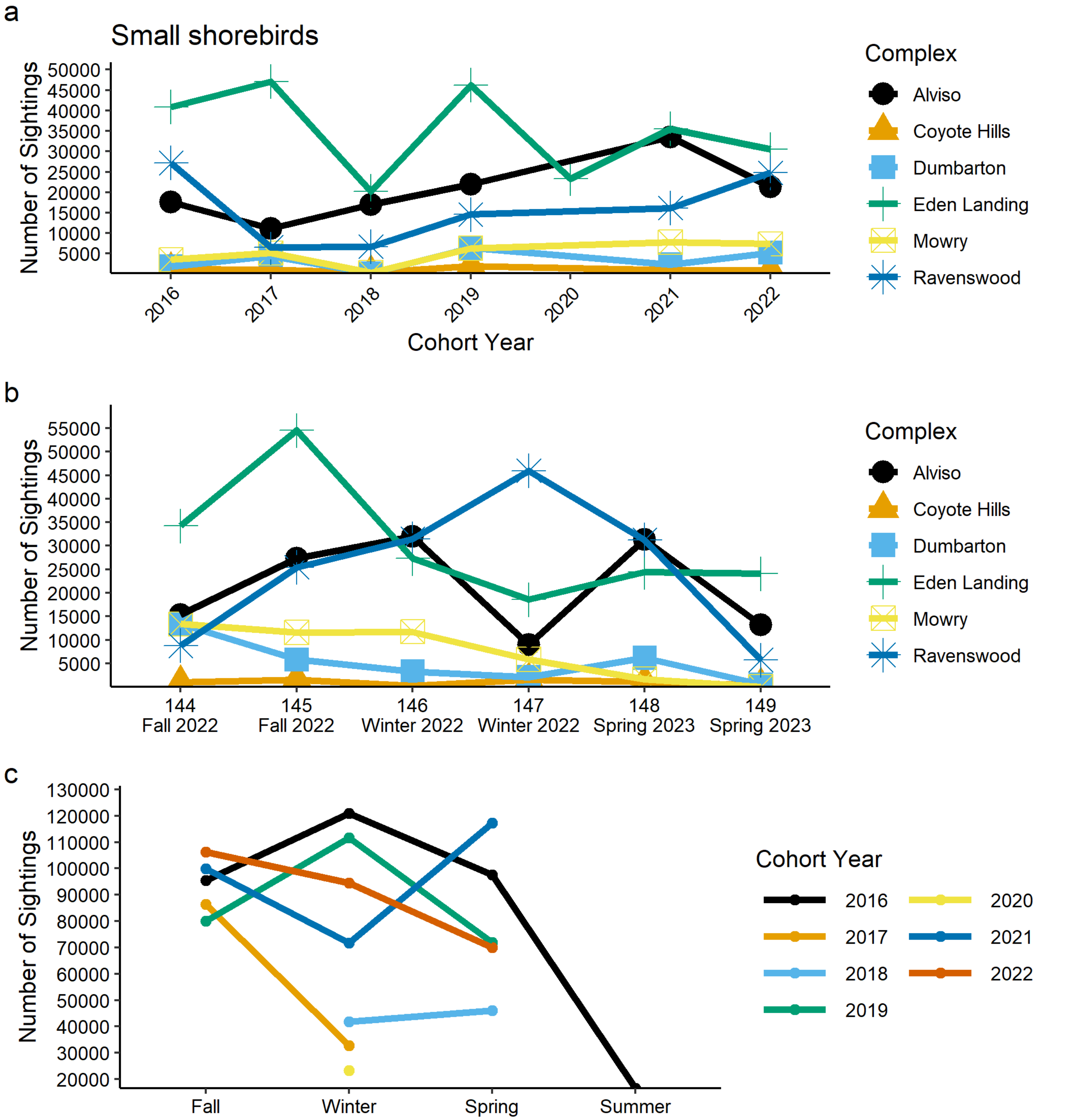

Figure 27. Abundance of small shorebirds by (a) study year (September to August of the following year) for each complex (averaged across surveys), (b) survey period for each complex during the current report period (September 2022 – May 2023), and (c) season for each study year at all salt production ponds combined; South San Francisco Bay, California, Sept. 2005 – May 2023 (averaged across surveys). Study years 2019 and 2020 contain incomplete surveys rounds; see the Introduction for details.

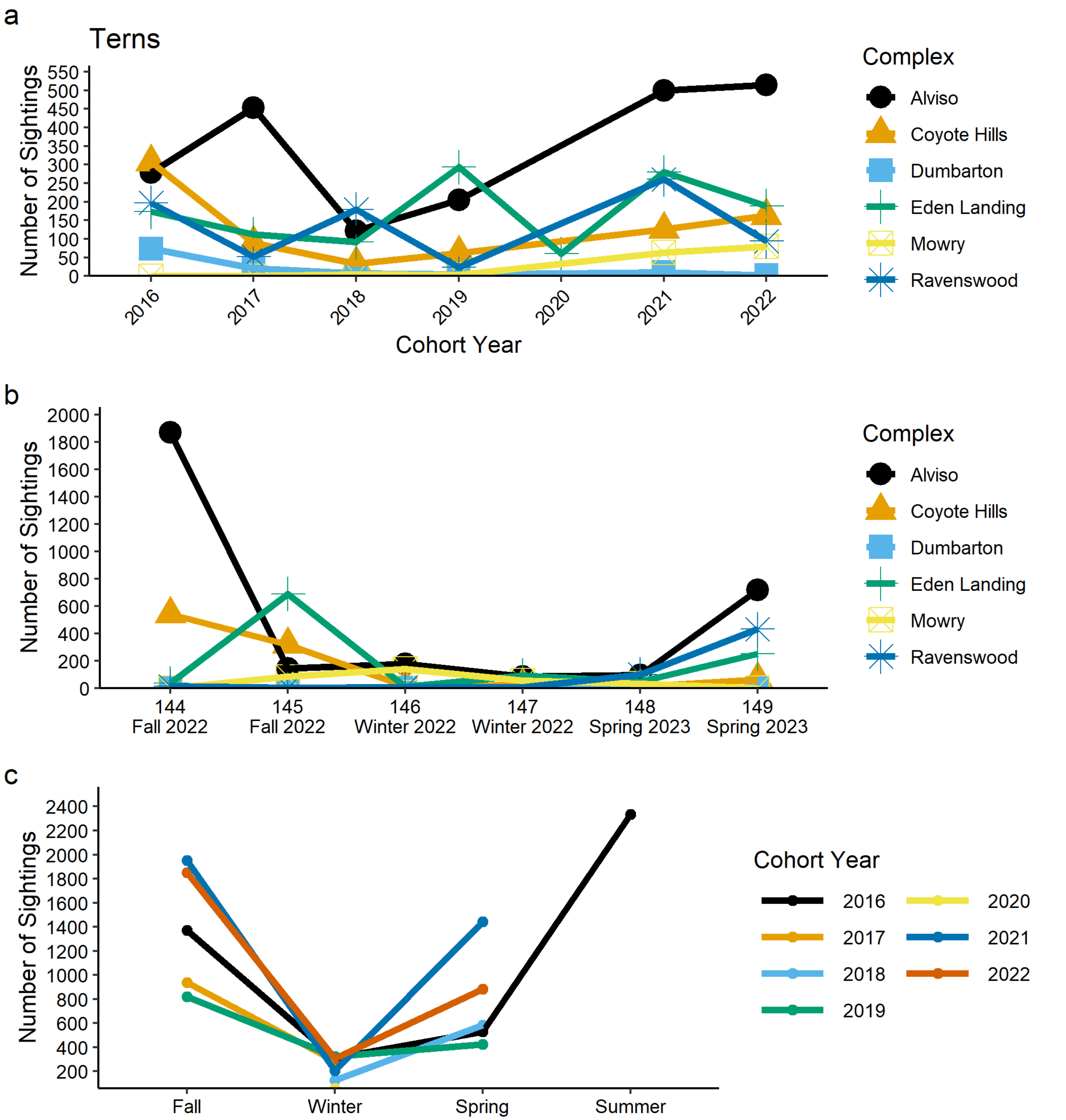

Figure 28. Abundance of terns by (a) study year (September to August of the following year) for each complex (averaged across surveys), (b) survey period for each complex during the current report period (September 2022 – May 2023), and (c) season for each study year at all salt production ponds combined; South San Francisco Bay, California, Sept. 2005 – May 2023 (averaged across surveys). Study years 2019 and 2020 contain incomplete surveys rounds; see the Introduction for details.

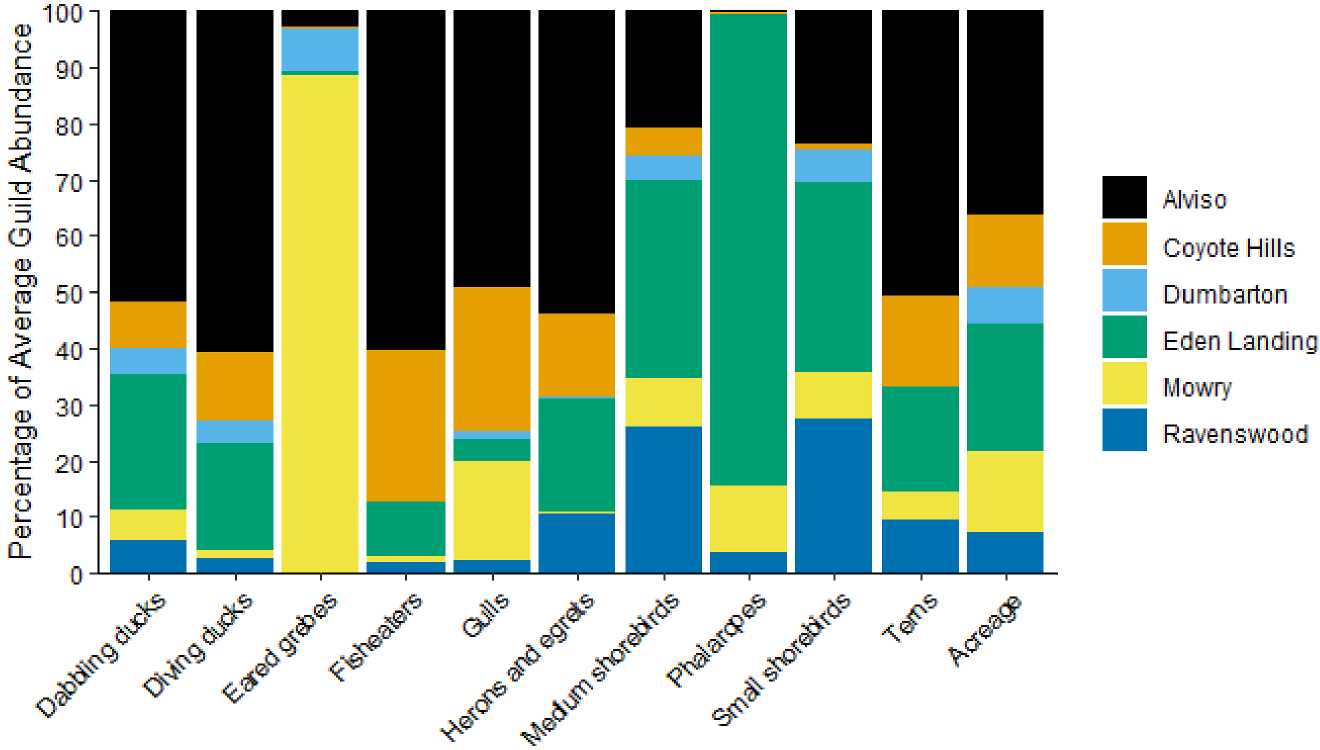

Figure 29. Percentage of average guild abundance by complex with relative acreage of the complexes, South San Francisco Bay, California; September 2022–May 2023. Reports prior to 2014 reported total abundance, rather than average abundance. Average abundance is more representative when sample sizes (number of surveys) are different between complexes, as was the case in 2014. If sample sizes are equal, total abundance and average abundance should result in the same proportions between complexes.

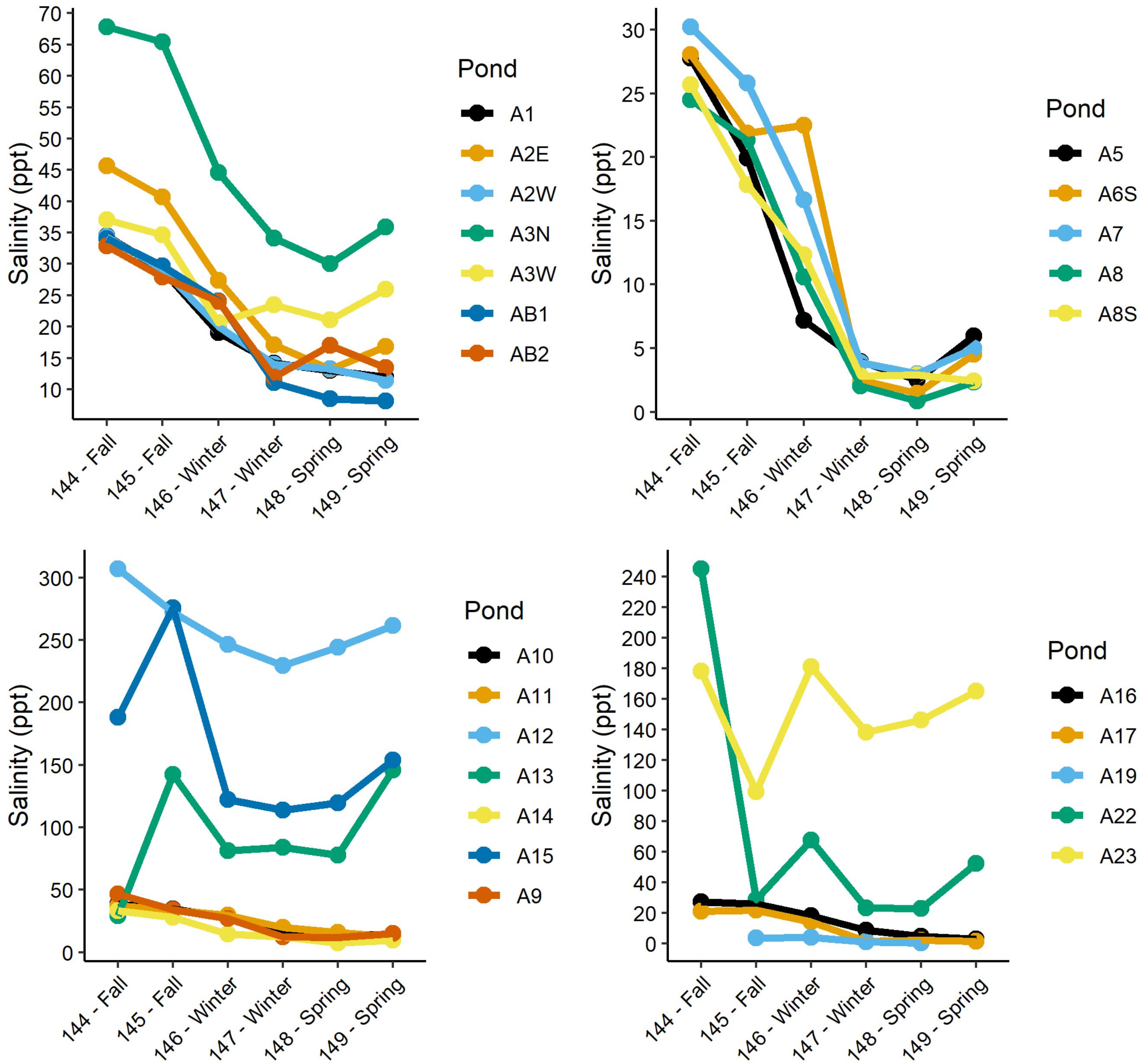

Figure 30. Average Salinity (ppt) at the Alviso pond complex, South San Francisco Bay, California; September 2022 – May 2023. Scale differs between graphs.

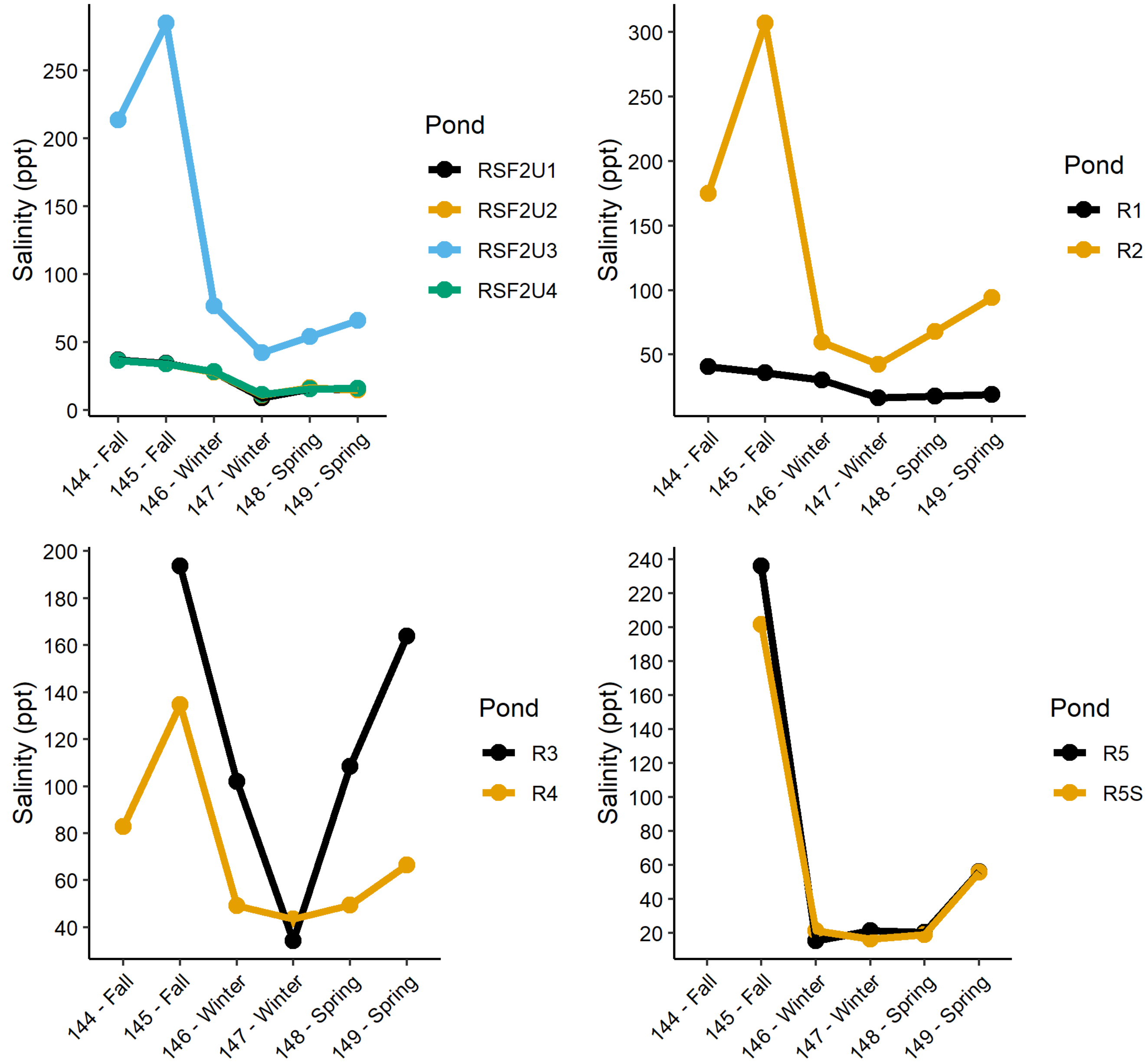

Figure 31. Average Salinity (ppt) at the Ravenswood pond complex, South San Francisco Bay, California; September 2022 – May 2023. Scale differs between graphs.

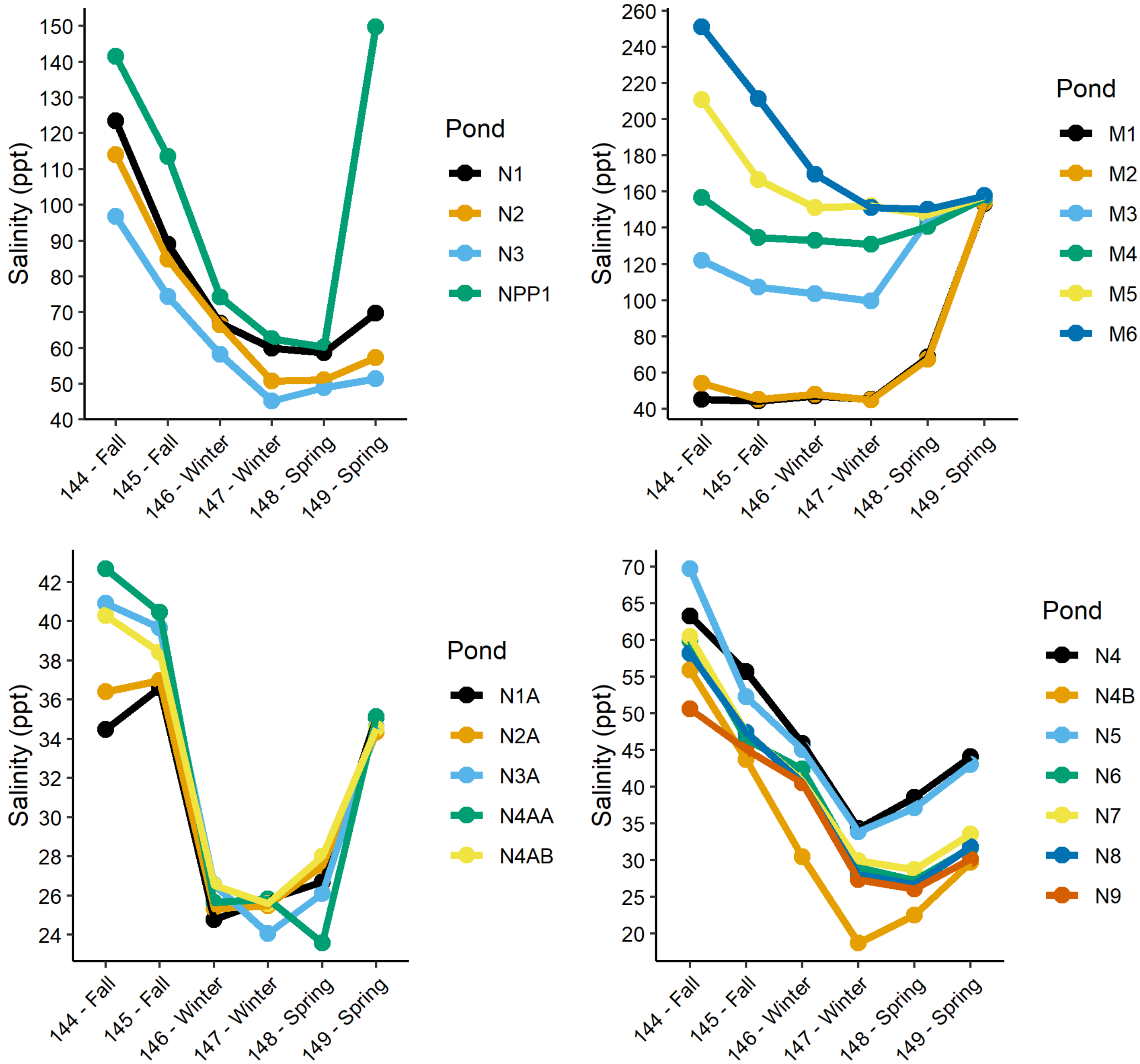

Figure 32. Average Salinity (ppt) at the Coyote Hills, Dumbarton, and Mowry pond complexes, South San Francisco Bay, California; September 2022 – May 2023. Scale differs between graphs.

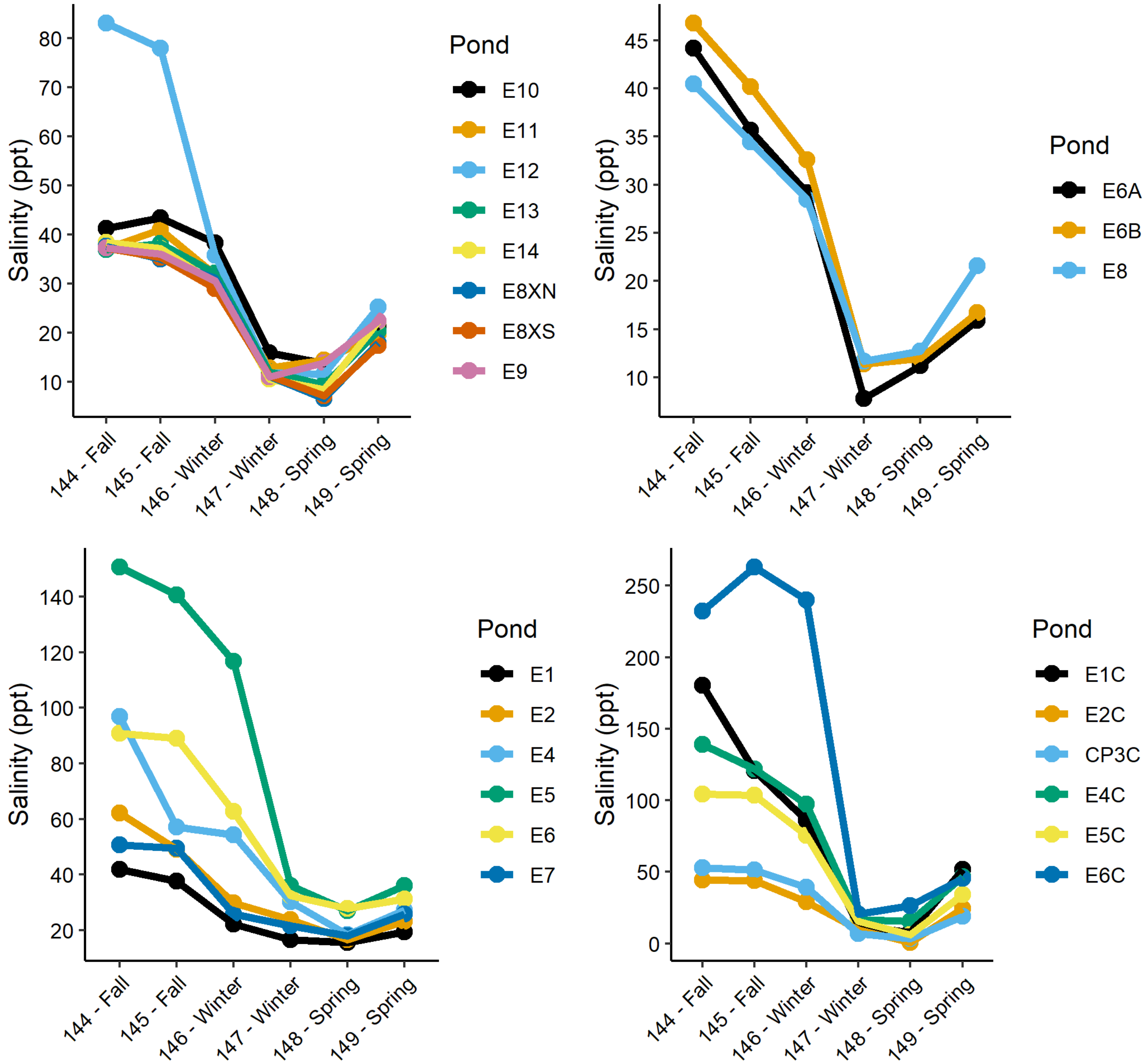

Figure 33. Average Salinity (ppt) at the Eden Landing pond complex, South San Francisco Bay, California; September 2022 – May 2023. Scale differs between graphs.

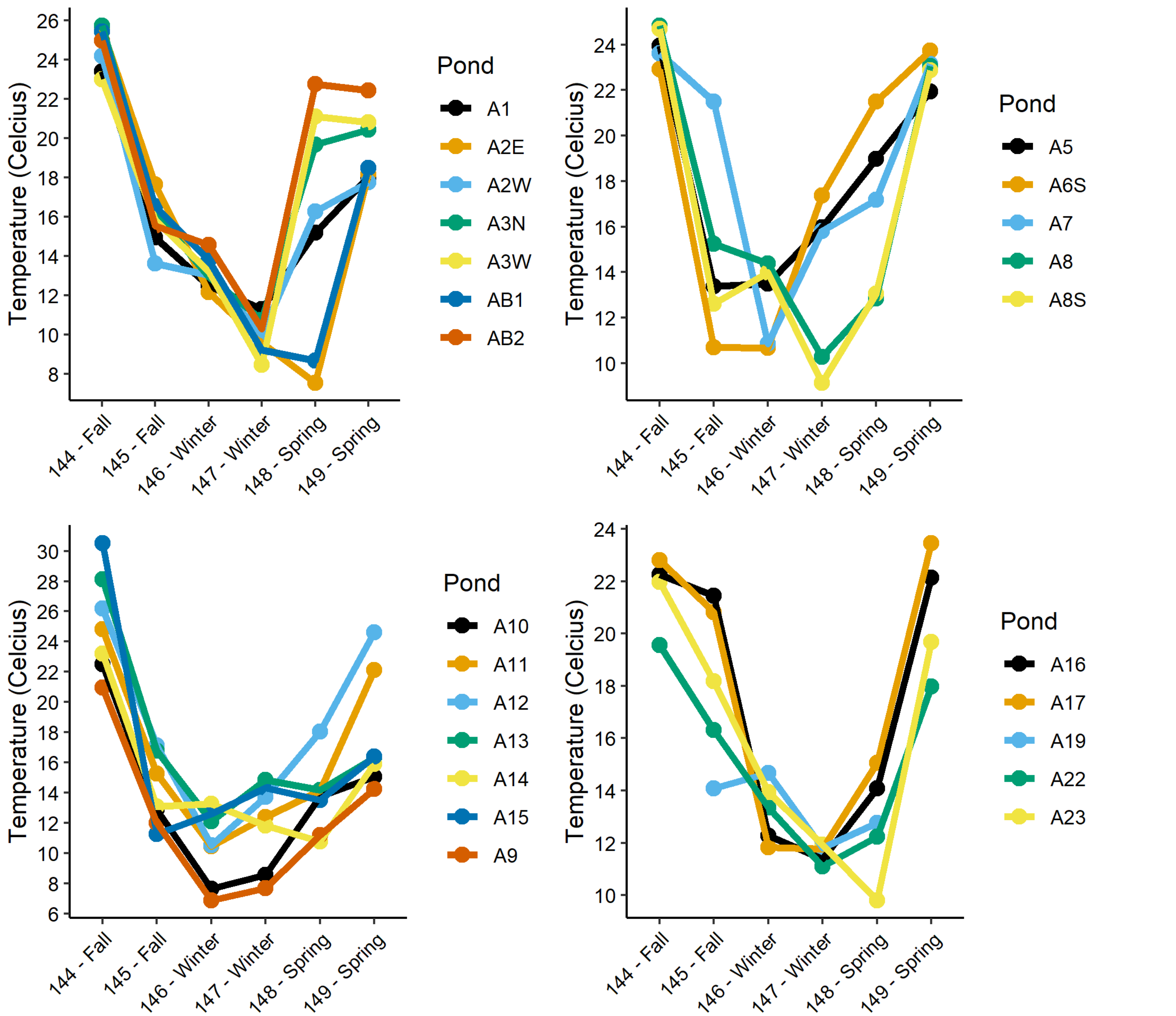

Figure 34. Average Temperature (Celsius) at the Alviso pond complex, South San Francisco Bay, California; September 2022 – May 2023. Scale differs between graphs.

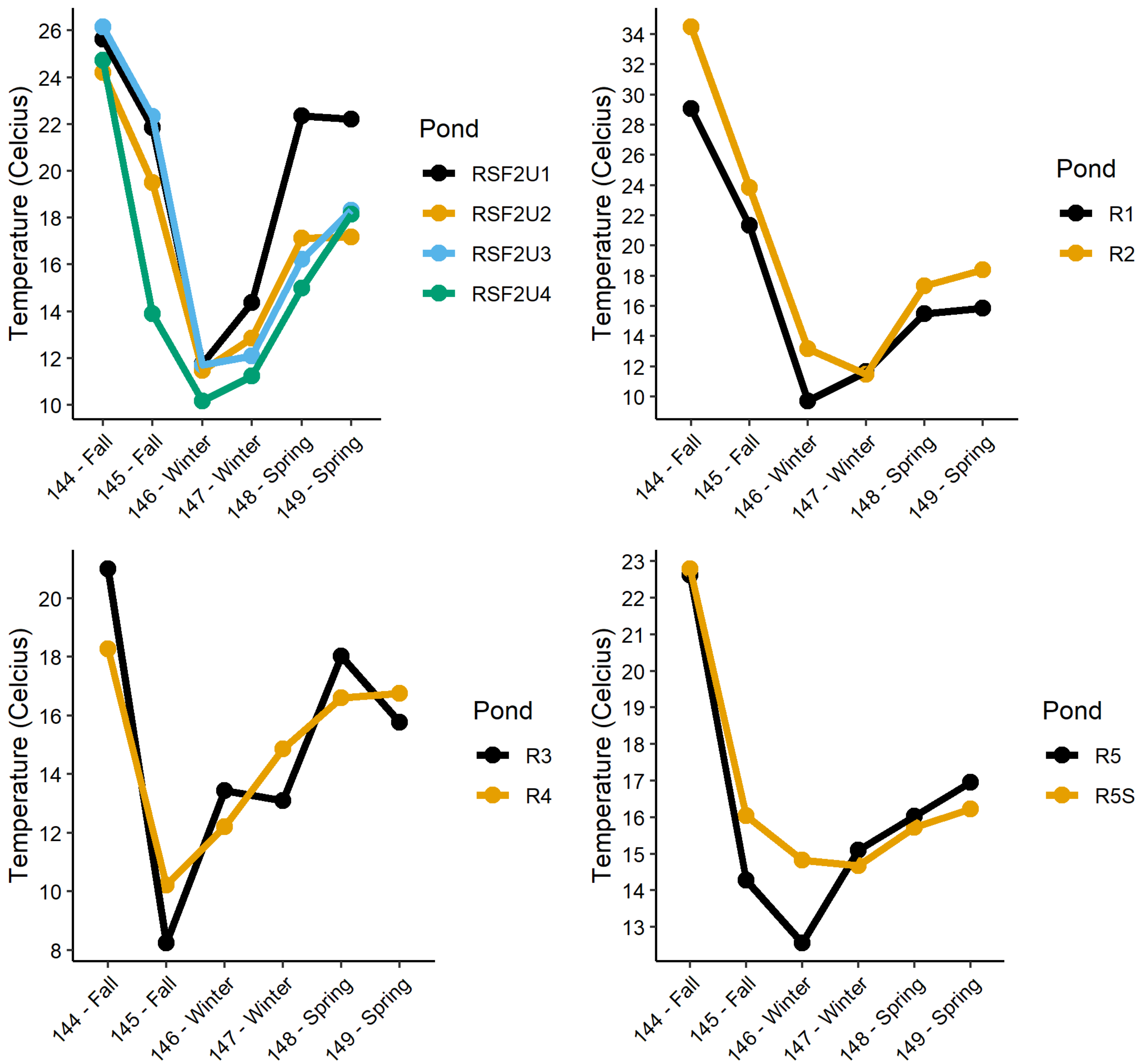

Figure 35. Average Temperature (Celsius) at the Ravenswood pond complex, South San Francisco Bay, California; September 2022 – May 2023. Scale differs between graphs.

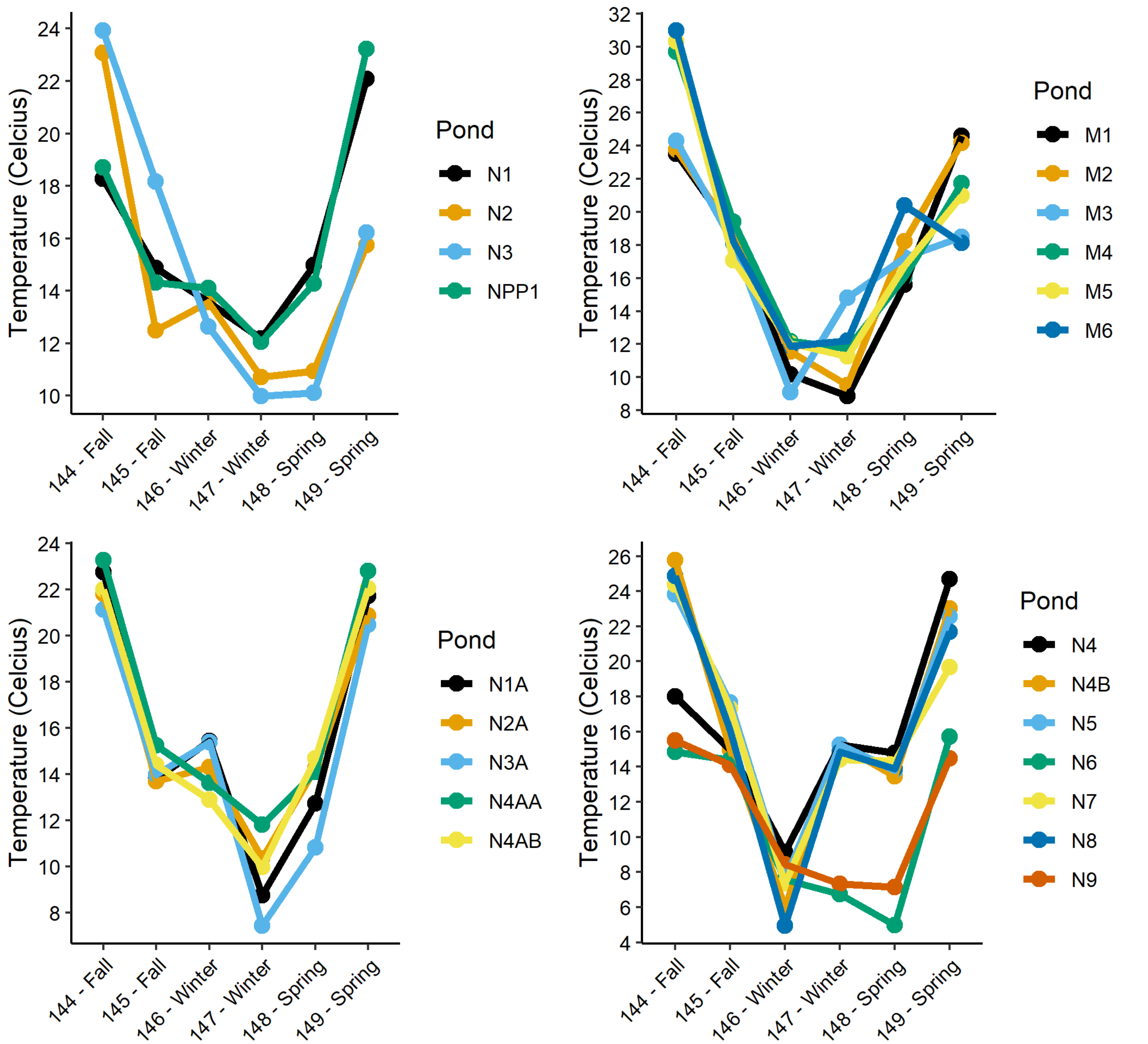

Figure 36. Average Temperature (Celsius) at the Coyote Hills, Dumbarton, and Mowry pond complexes, South San Francisco Bay, California; September 2022 – May 2023. Scale differs between graphs.

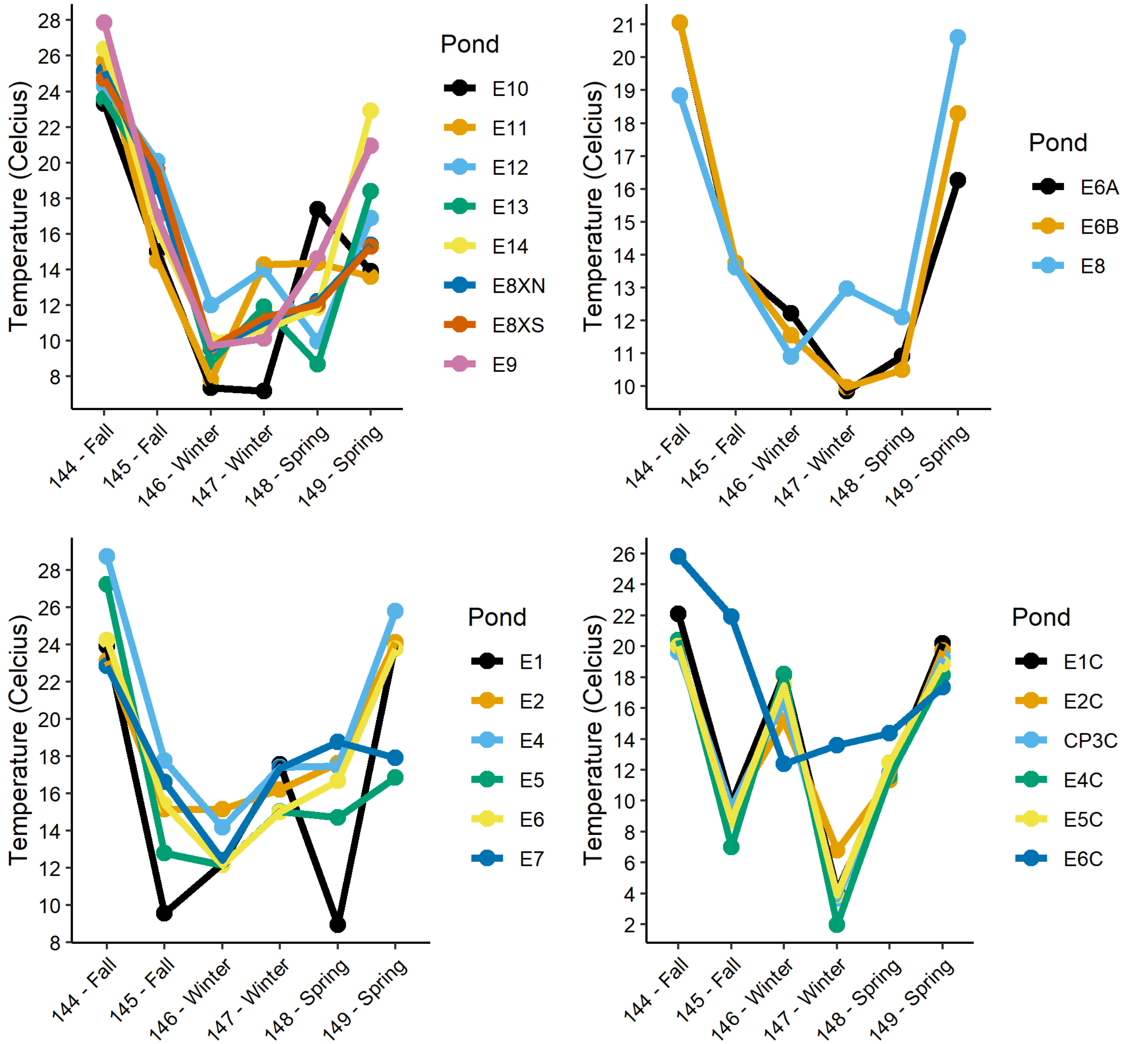

Figure 37. Average Temperature (Celsius) at the Eden Landing pond complex, South San Francisco Bay, California; September 2022 – May 2023. Scale differs between graphs.

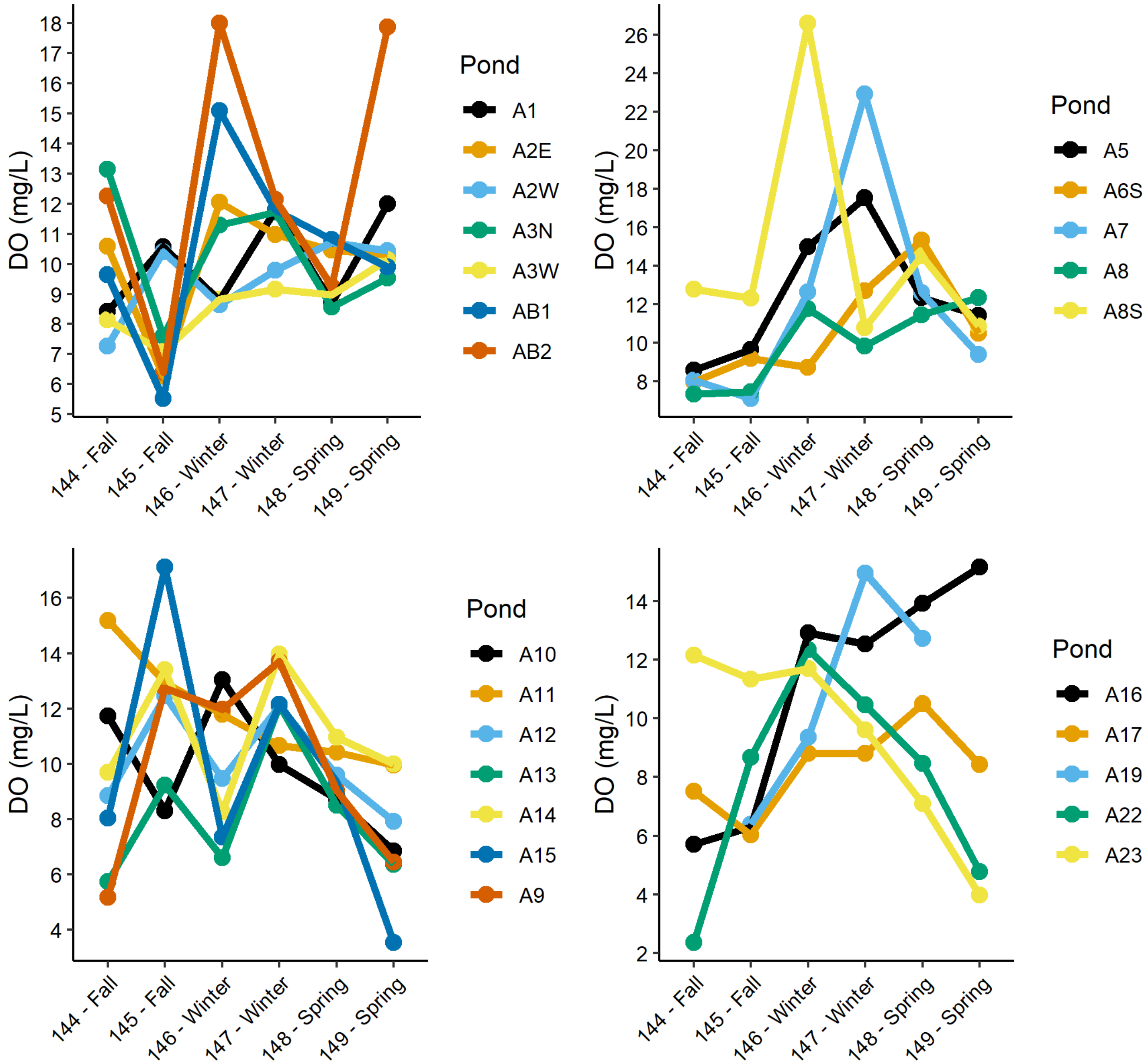

Figure 38. Average DO (mg/L) at the Alviso pond complex, South San Francisco Bay, California; September 2022 – May 2023. Scale differs between graphs.

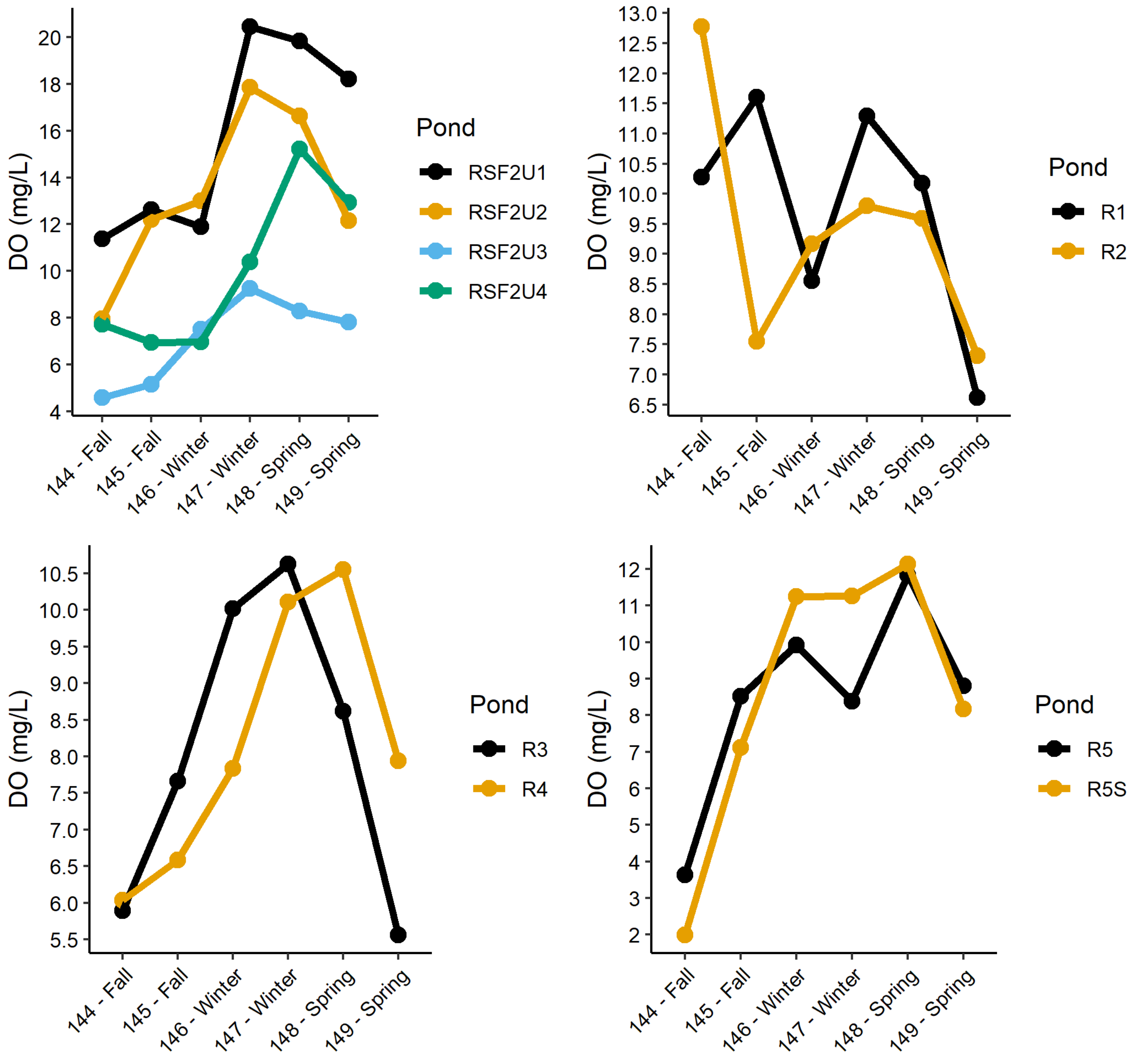

Figure 39. Average DO (mg/L) at the Ravenswood pond complex, South San Francisco Bay, California; September 2022 – May 2023. Scale differs between graphs.

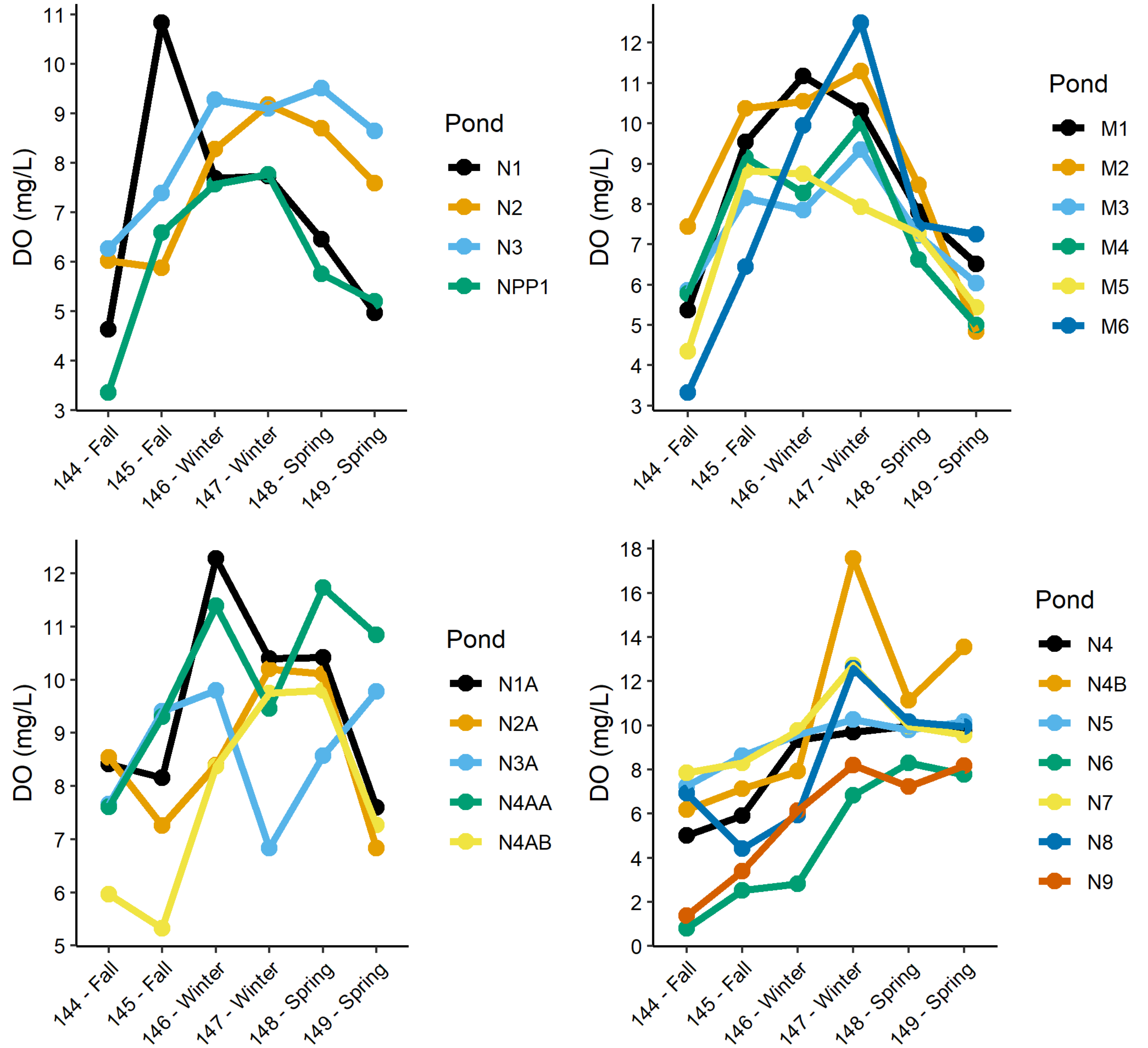

Figure 40. Average DO (mg/L) at the Coyote Hills, Dumbarton, and Mowry pond complexes, South San Francisco Bay, California; September 2022 – May 2023. Scale differs between graphs.

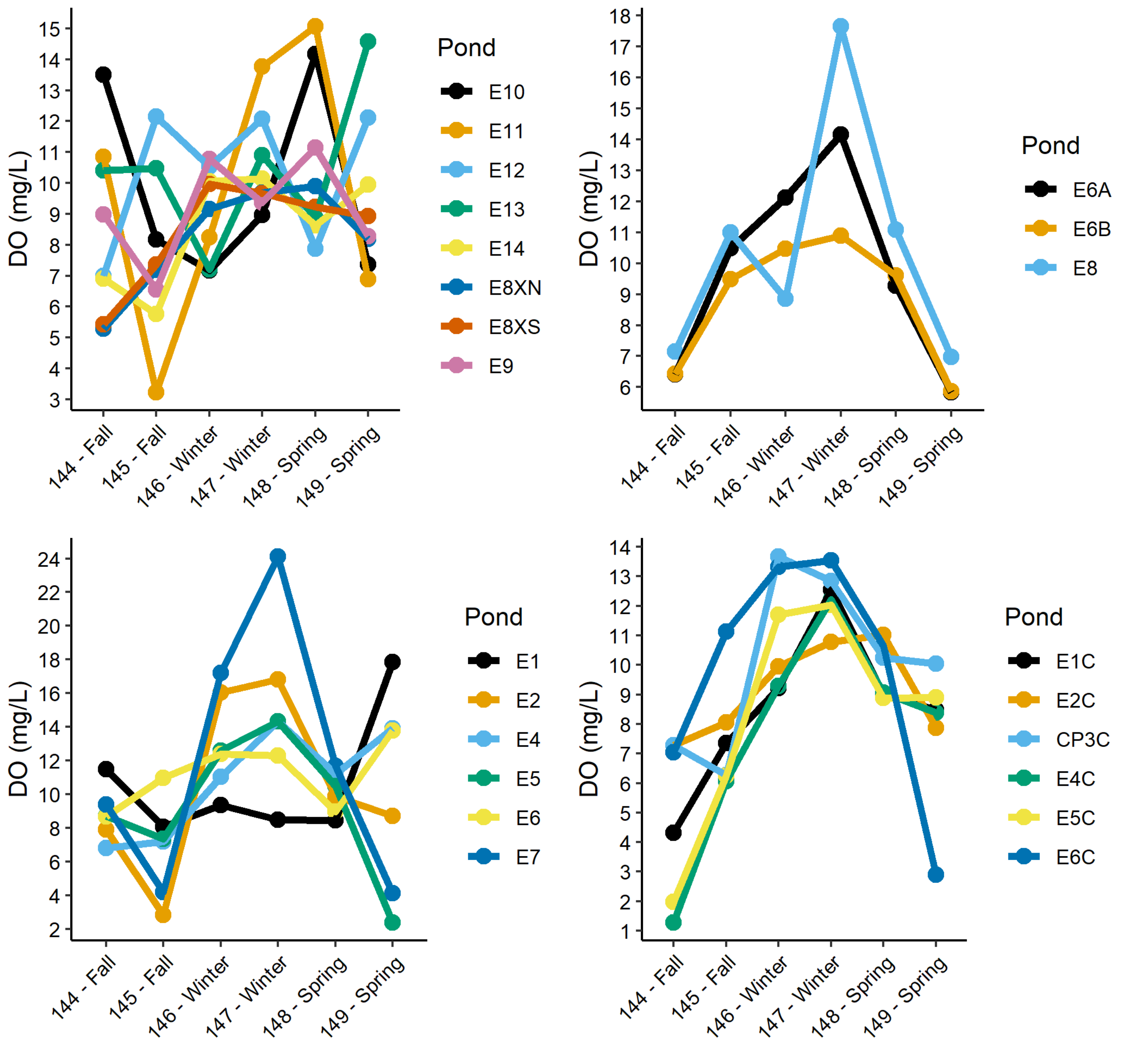

Figure 41. Average DO (mg/L) at the Eden Landing pond complex, South San Francisco Bay, California; September 2022 – May 2023. Scale differs between graphs.

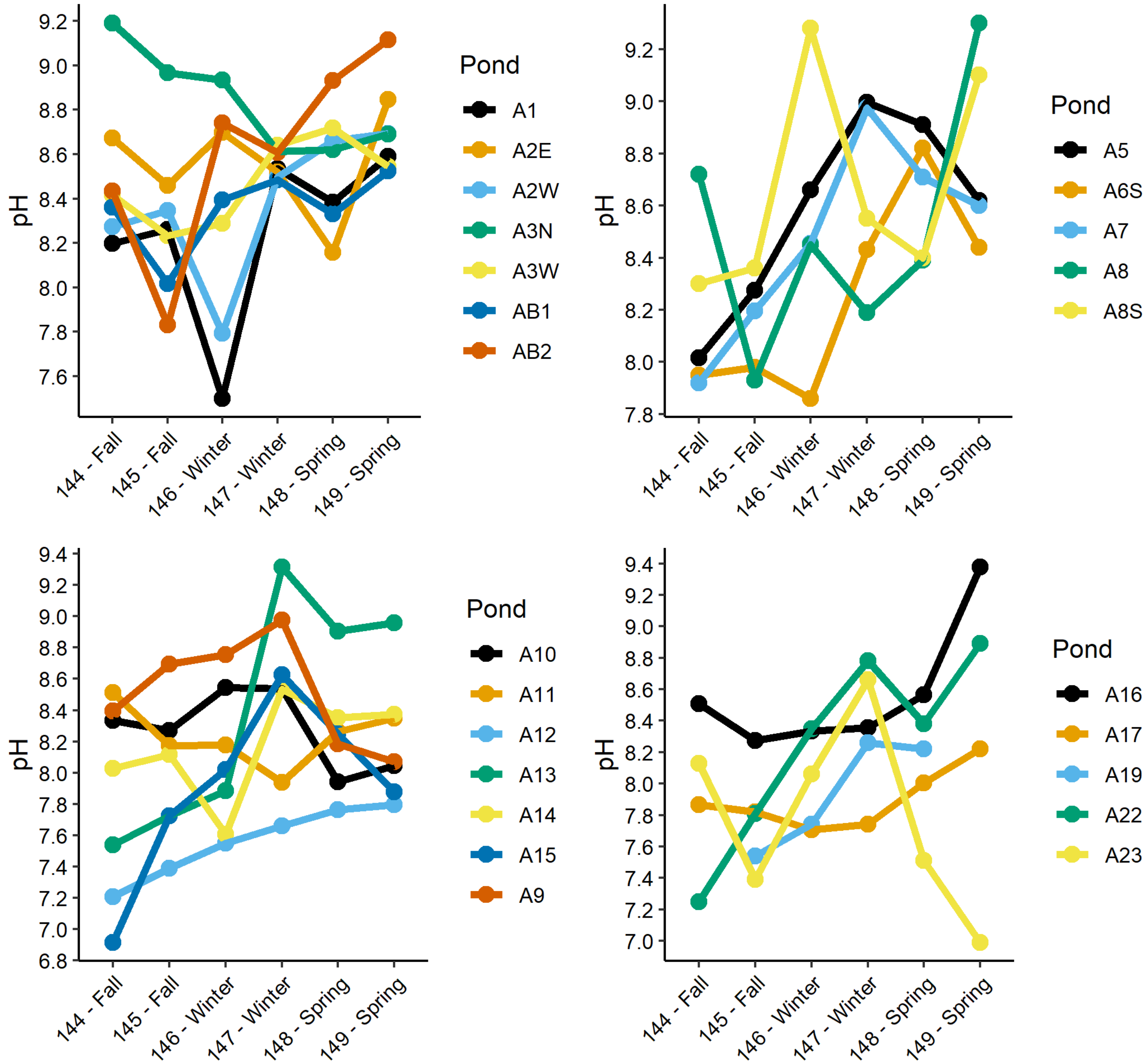

Figure 42. Average pH at the Alviso pond complex, South San Francisco Bay, California; September 2022 – May 2023. Scale differs between graphs.

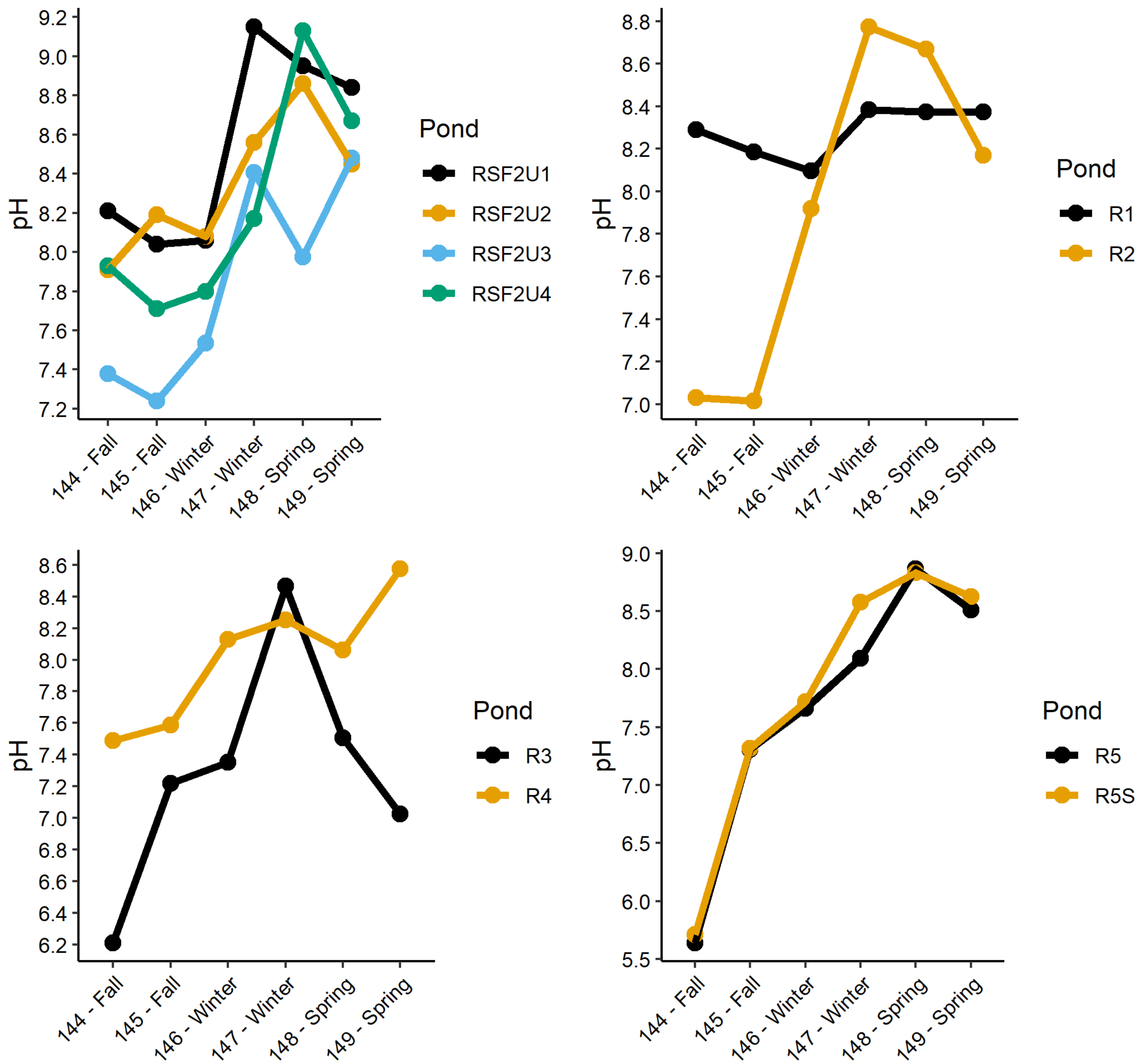

Figure 43. Average pH at the Ravenswood pond complex, South San Francisco Bay, California; September 2022 – May 2023. Scale differs between graphs.

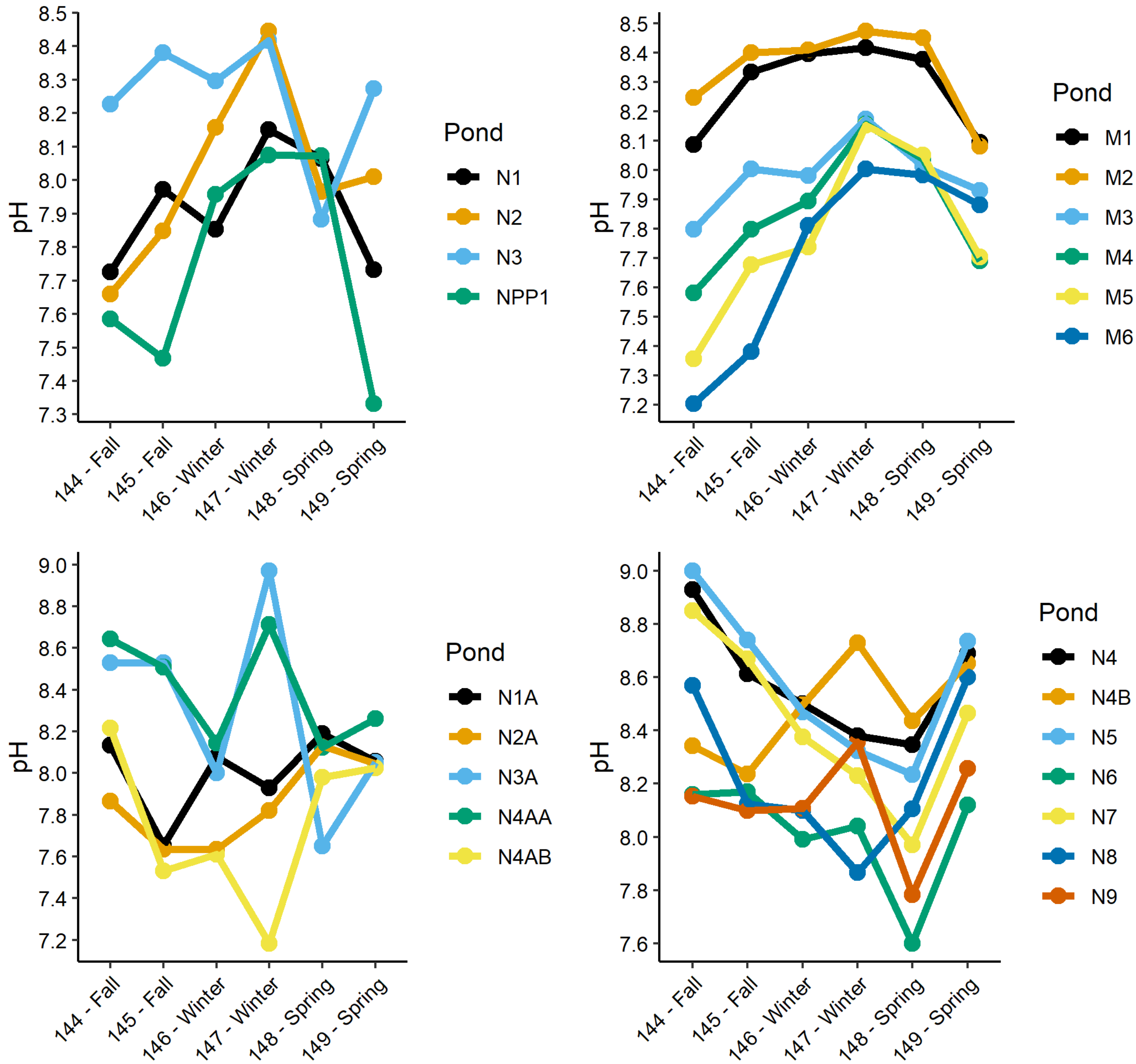

Figure 44. Average pH at the Coyote Hills, Dumbarton, and Mowry pond complexes, South San Francisco Bay, California; September 2022 – May 2023. Scale differs between graphs.

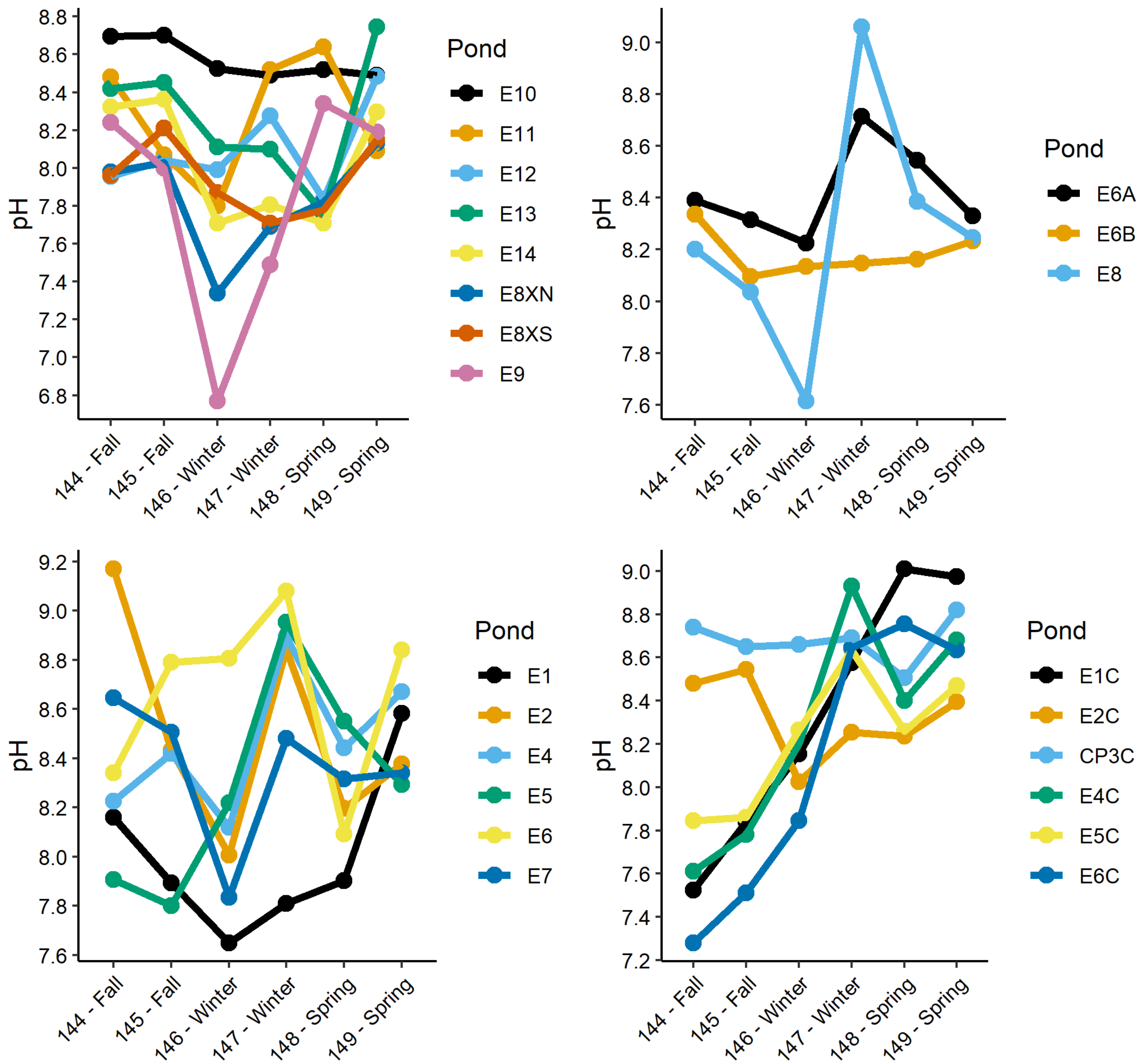

Figure 45. Average pH at the Eden Landing pond complex, South San Francisco Bay, California; September 2022 – May 2023. Scale differs between graphs.

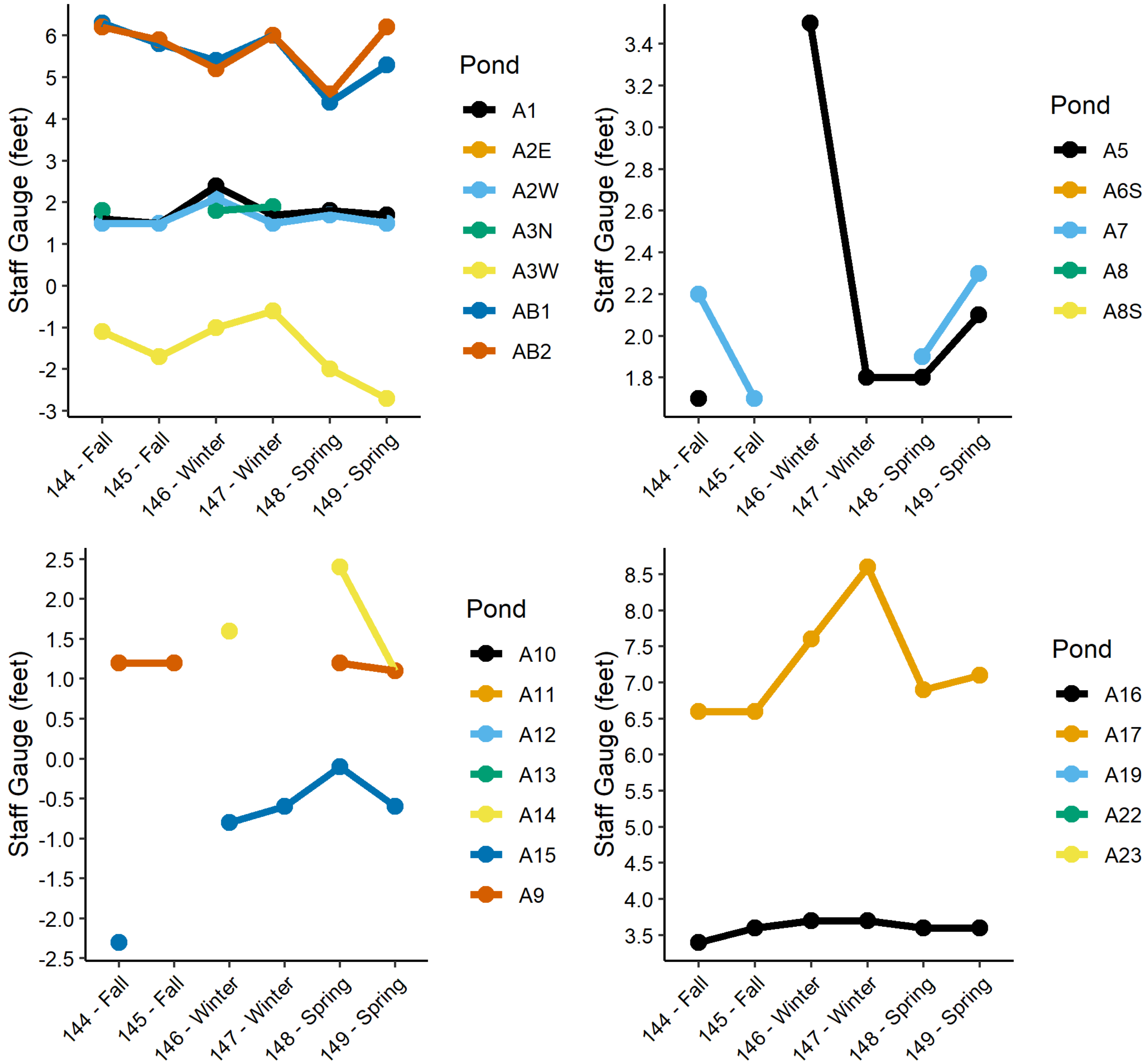

Figure 46. Average Staff Gauge (feet) at the Alviso pond complex, South San Francisco Bay, California; September 2022 – May 2023. Scale differs between graphs.

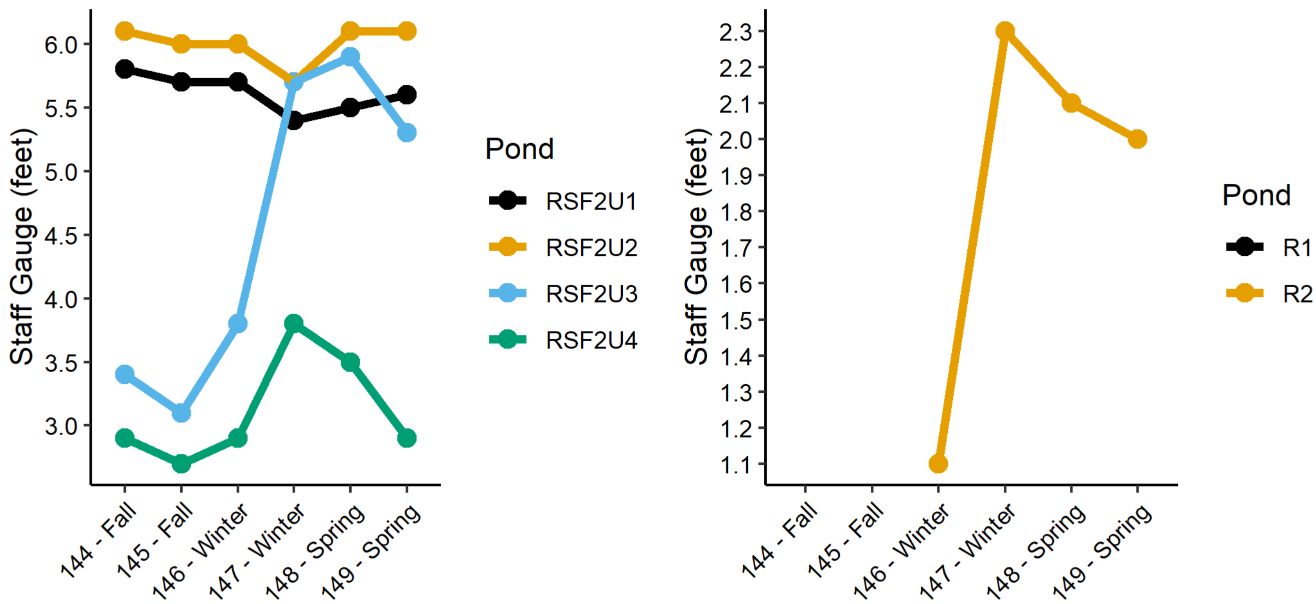

Figure 47. Average Staff Gauge (feet) at the Ravenswood pond complex, South San Francisco Bay, California; September 2022 – May 2023. Scale differs between graphs. Staff gauges were not readable at ponds R1, R2, R5, and R5S.

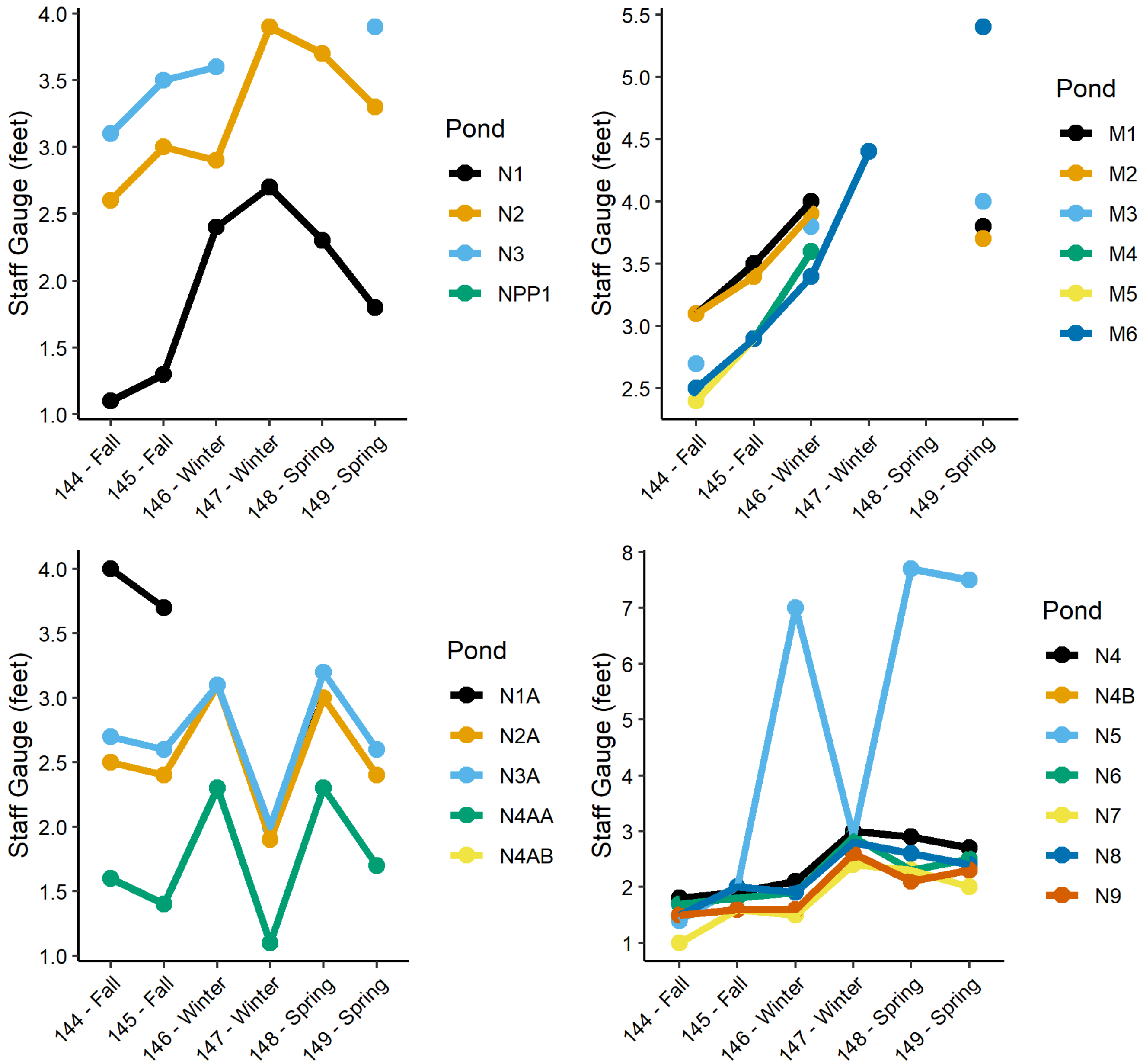

Figure 48. Average Staff Gauge (feet) at the Coyote Hills, Dumbarton, and Mowry pond complexes, South San Francisco Bay, California; September 2022 – May 2023. Scale differs between graphs.

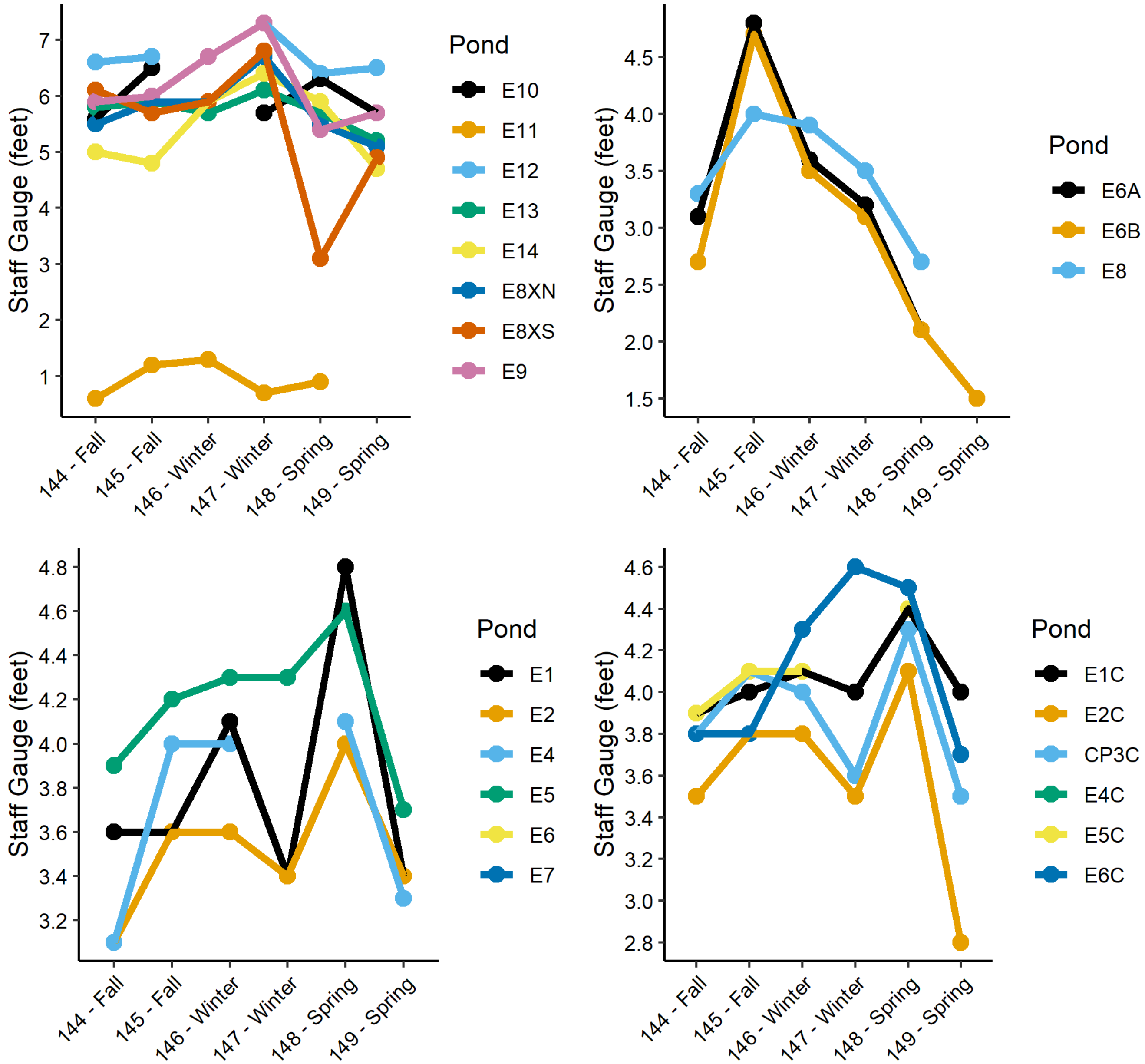

Figure 49. Average Staff Gauge (feet) at the Eden Landing pond complex, South San Francisco Bay, California; September 2022 – May 2023. Scale differs between graphs.

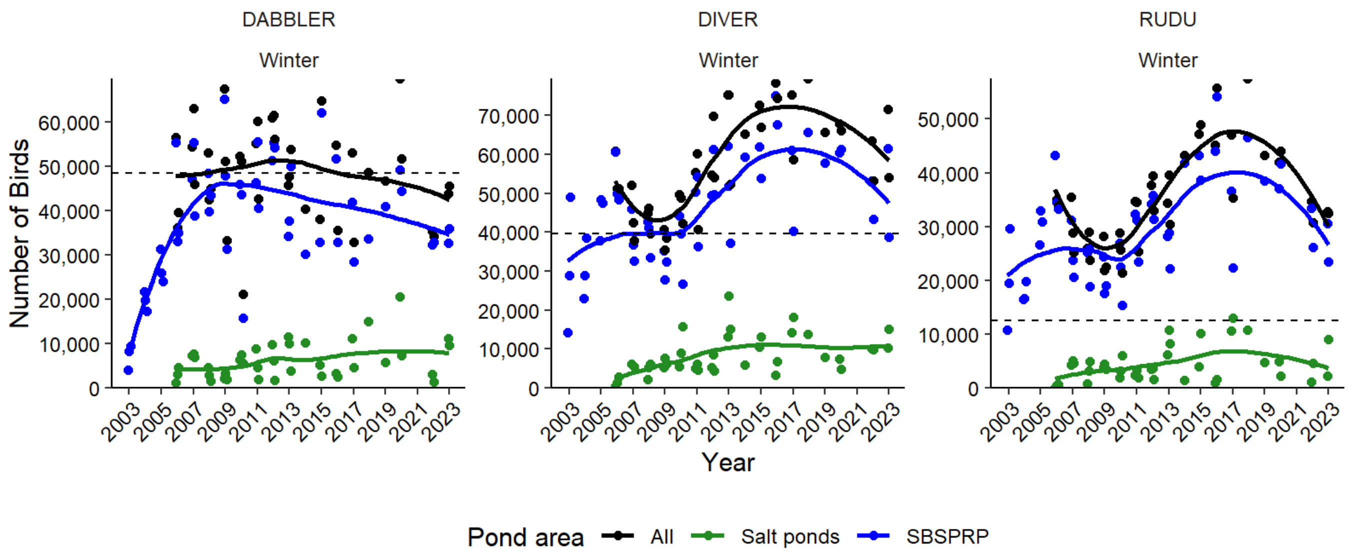

Figure 50. Counts of dabbling ducks, diving ducks, and Ruddy Ducks (RUDU) during peak seasons within the SBSPRP and salt production ponds. Lines represent LOESS curves and the dashed lines denote SBSPRP Targets or baseline values (average counts from 2005-2007).

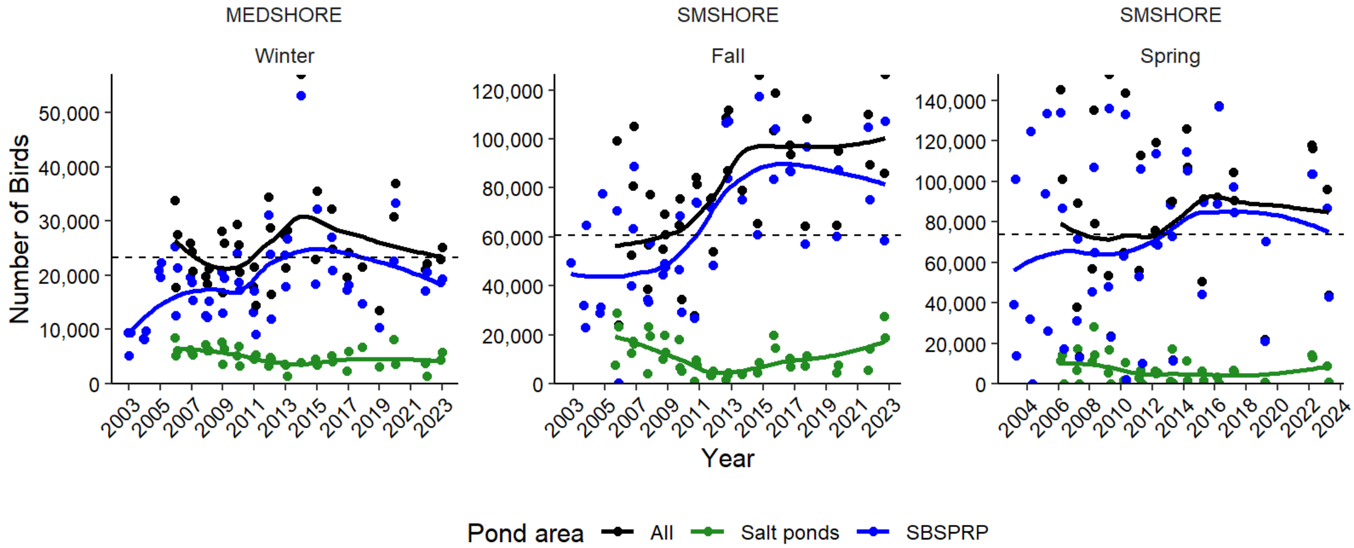

Figure 51. Counts of medium and small shorebirds during peak seasons within the SBSPRP and salt production ponds. Lines represent LOESS curves and the dashed lines denote SBSPRP targets or baseline values (average counts from 2005-2007).

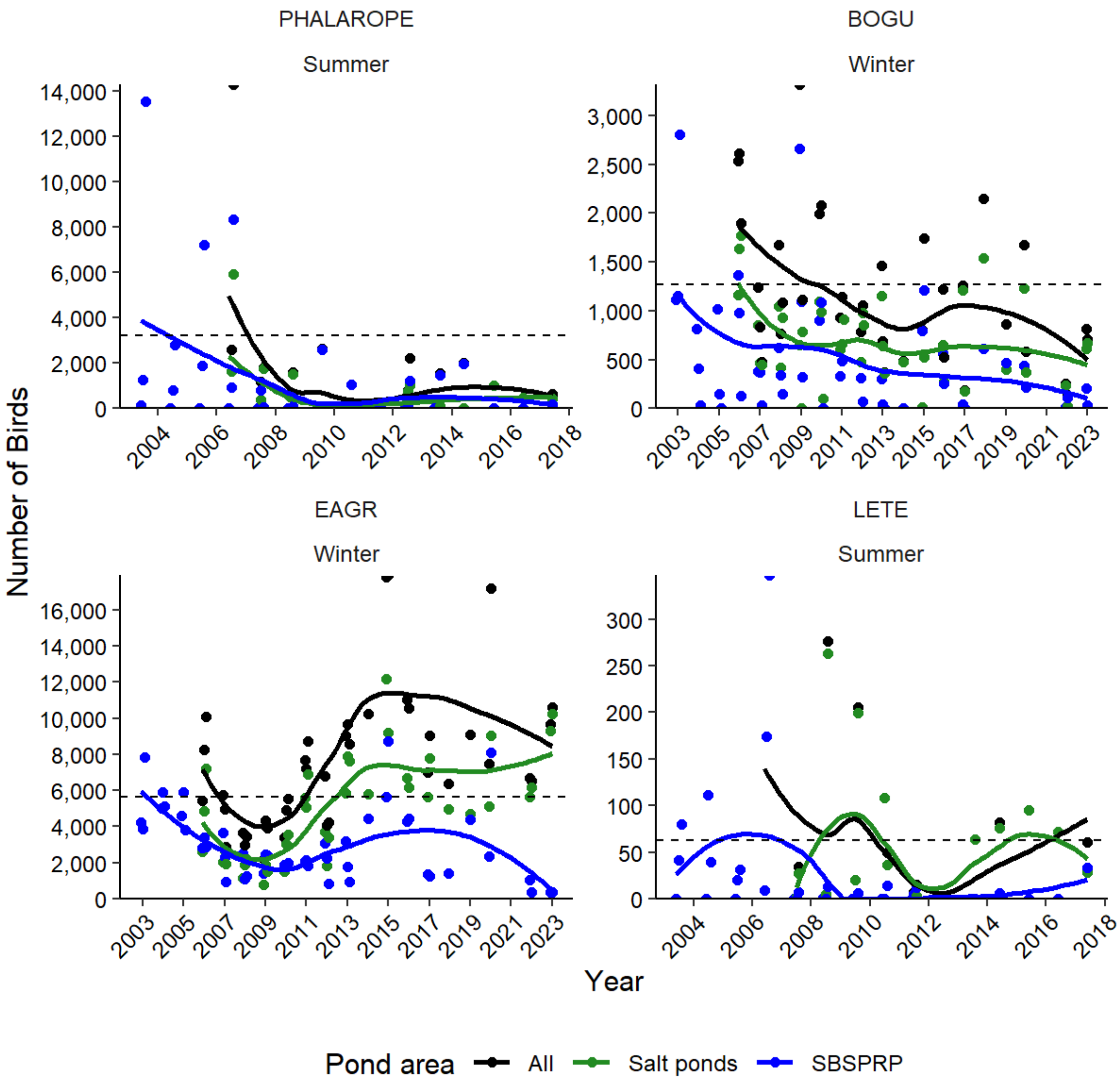

Figure 52. Counts of phalaropes (PHAL), Bonaparte's Gulls (BOGU), Eared Grebe (EAGR), and Least Terns (LETE) during peak seasons within the SBSPRP and salt production ponds. Lines represent LOESS curves and the dashed lines denote SBSPRP targets or baseline values (average counts from 2005-2007).

Appendix I

Table A1.1. Species assignments to foraging guilds. Guilds included dabblers, divers, Eared Grebes, fisheaters, gulls, herons, medium shorebirds, phalaropes, small shorebirds, and terns.

Common Name	Species Code	Scientific Name	Guild
American Coot	AMCO	*Fulica americana*	DABBLER
American Green-winged Teal	AGWT	*Anas crecca*	DABBLER
American Wigeon	AMWI	*Anas americana*	DABBLER
Blue-winged Teal	BWTE	*Anas discors*	DABBLER
Cinnamon Teal	CITE	*Anas cyanoptera*	DABBLER
Common Moorhen	COMO	*Gallinula chloropus*	DABBLER
Domestic Mallard	DOMA	*Anas spp*	DABBLER
Eurasian Wigeon	EUWI	*Anas penelope*	DABBLER
Gadwall	GADW	*Anas strepera*	DABBLER
Green-winged Teal	GWTE	*Anas crecca*	DABBLER
Long-tailed Duck	LTDU	*Clangula hyemalis*	DABBLER
Mallard	MALL	*Anas platyrhynchos*	DABBLER
Northern Pintail	NOPI	*Anas acuta*	DABBLER
Northern Shoveler	NSHO	*Anas clypeata*	DABBLER
Unidentified dabbling duck	DABB	*dabbling duck spp.*	DABBLER
Barrow's Goldeneye	BAGO	*Bucephala islandica*	DIVER
Bufflehead	BUFF	*Bucephala albeola*	DIVER
Canvasback	CANV	*Aythya valisineria*	DIVER
Common Goldeneye	COGO	*Bucephala clangula*	DIVER
Greater Scaup	GRSC	*Aythya marila*	DIVER
Lesser Scaup	LESC	*Aythya affinis*	DIVER
Redhead	REDH	*Aythya americana*	DIVER
Ring-necked Duck	RNDU	*Aythya collaris*	DIVER
Ruddy Duck	RUDU	*Oxyura jamaicensis*	DIVER
Surf Scoter	SUSC	*Melanitta perspicillata*	DIVER

Common Name	**Species Code**	**Scientific Name**	**Guild**
Tufted Duck	TUDU	*Aythya fuligula*	DIVER
Unidentified diving duck	DIVE	*diving duck spp.*	DIVER
Unidentified scaup	SCAU	*Aythya spp.*	DIVER
White-winged scoter	WWSC	*Melanitta fusca*	DIVER
Eared Grebe	EAGR	*Podiceps nigricollis*	EAREDGR
American White Pelican	AWPE	*Pelecanus erythrorhynchos*	FISHEAT
Belted Kingfisher	BEKI	*Ceryle alcyon*	FISHEAT
Black Skimmer	BLSK	*Rhynchops niger*	FISHEAT
Brown Booby	BRBO	*Sula leucogaster*	FISHEAT
Brown Pelican	BRPE	*Pelecanus occidentalis*	FISHEAT
Clark's Grebe	CLGR	*Aechmophorus clarkii*	FISHEAT
Common Loon	COLO	*Gavia immer*	FISHEAT
Common Merganser	COME	*Mergus merganser*	FISHEAT
Double-crested Cormorant	DCCO	*Phalacrocorax auritus*	FISHEAT
Hooded Merganser	HOME	*Lophodytes cucullatus*	FISHEAT
Horned Grebe	HOGR	*Podiceps auritus*	FISHEAT
Long-tailed Jaeger	LTJA	*Stercorarius longicaudus*	FISHEAT
Pacific Loon	PALO	*Gavia pacifica*	FISHEAT
Pelagic Cormorant	PECO	*Phalacrocorax pelagicus*	FISHEAT
Pied-billed Grebe	PBGR	*Podilymbus podiceps*	FISHEAT
Red-breasted Merganser	RBME	*Mergus serrator*	FISHEAT
Red-necked Grebe	RNGR	*Podiceps grisegena*	FISHEAT
Red-throated Loon	RTLO	*Gavia stellata*	FISHEAT
Unidentified Cormorant	CORM	*Phalacrocorax* spp.	FISHEAT
Unidentified grebe	GREBE	N/A	FISHEAT
Western Grebe	WEGR	*Aechmophorus occidentalis*	FISHEAT
Western Grebe or Clark's Grebe	WEGR/CLGR	*Aechmophorus* spp.	FISHEAT
Bonaparte's Gull	BOGU	*Larus philadelphia*	GULL

Common Name	Species Code	Scientific Name	Guild
California Gull	CAGU	*Larus californicus*	GULL
California Gull or Ring-billed Gull	CAGU/RBGU	*Larus* spp.	GULL
Franklin's Gull	FRGU	*Larus pipixcan*	GULL
Glaucous-winged Gull	GWGU	*Larus glaucescens*	GULL
Glaucous Gull	GLGU	*Larus hyperboreus*	GULL
Herring Gull	HERG	*Larus argentatus*	GULL
Mew Gull	MEGU	*Larus canus*	GULL
Ring-billed Gull	RBGU	*Larus delawarensis*	GULL
Sabine's Gull	SAGU	*Xena sabini*	GULL
Slaty-backed Gull	SBGU	*Larus schistisagus*	GULL
Thayer's Gull	THGU	*Larus thayeri*	GULL
Unidentified gull	GULL	*Larus* spp.	GULL
Western Gull	WEGU	*Larus occidentalis*	GULL
American Bittern	AMBI	*Botarus lentiginosus*	HERON
Black-crowned Night-Heron	BCNH	*Nycticorax nycticorax*	HERON
Cattle Egret	CAEG	*Bubulcus ibis*	HERON
Great Blue Heron	GBHE	*Ardea herodias*	HERON
Great Egret	GREG	*Ardea alba*	HERON
Green Heron	GRHE	*Butorides virescens*	HERON
Little Blue Heron	LBHE	*Egretta caerulea*	HERON
Snowy Egret	SNEG	*Egretta thula*	HERON
White-faced Ibis	WFIB	*Plegadis chihi*	HERON
American Avocet	AMAV	*Recurvirostra americana*	MEDSHORE
Black-bellied Plover	BBPL	*Pluvialis squatarola*	MEDSHORE
Black-necked Stilt	BNST	*Himantopus mexicanus*	MEDSHORE
Black Oystercatcher	BLOY	*Haematopus bachmani*	MEDSHORE
Black Turnstone	BLTU	*Arenaria melanocephala*	MEDSHORE
Common Snipe	COSN	*Gallinago gallinago*	MEDSHORE

Common Name	Species Code	Scientific Name	Guild
Golden Plover	GOPL	*Pluvialis spp.*	MEDSHORE
Greater Yellowlegs	GRYE	*Tringa melanoleuca*	MEDSHORE
Killdeer	KILL	*Charadrius vociferus*	MEDSHORE
Lesser Yellowlegs	LEYE	*Tringa flavipes*	MEDSHORE
Long-billed Curlew	LBCU	*Numenius americanus*	MEDSHORE
Marbled Godwit	MAGO	*Limosa fedoa*	MEDSHORE
Pacific Golden-Plover	PAGP	*Pluvialis fulva*	MEDSHORE
Red Knot	REKN	*Calidris canutus*	MEDSHORE
Ruddy Turnstone	RUTU	*Arenaria interpres*	MEDSHORE
Ruff	RUFF	*Philomachus pugnax*	MEDSHORE
Spotted Redshank	SPRE	*Tringa erythropus*	MEDSHORE
Stilt Sandpiper	STSA	*Calidris himantopus*	MEDSHORE
Surfbird	SURF	*Aphriza virgata*	MEDSHORE
Unidentifed yellowlegs	YELL	*Tringa spp.*	MEDSHORE
Unidentified medium shorebird	SHOR	*med shorebird spp.*	MEDSHORE
Wandering Tattler	WATA	*Tringa incana*	MEDSHORE
Whimbrel	WHIM	*Numenius phaeopus*	MEDSHORE
Willet	WILL	*Catoptrophorus semipalmatus*	MEDSHORE
Red-necked Phalarope	RNPH	*Phalaropus lobatus*	PHAL
Red Phalarope	REPH	*Phalaropus fulicaria*	PHAL
Unidentified phalarope	PHAL	*Phalaropus spp.*	PHAL
Wilson's Phalarope	WIPH	*Phalaropus tricolor*	PHAL
Baird's Sandpiper	BASA	*Calidris bairdii*	SMSHORE
Dunlin	DUNL	*Calidris alpina*	SMSHORE
Least Sandpiper	LESA	*Calidris minutilla*	SMSHORE
Long-billed Dowitcher	LBDO	*Limnodromus scolopaceus*	SMSHORE
Pectoral Sandpiper	PESA	*Calidris melanotos*	SMSHORE
Sanderling	SAND	*Calidris alba*	SMSHORE

Common Name	Species Code	Scientific Name	Guild
Semipalmated Plover	SEPL	*Charadrius semipalmatus*	SMSHORE
Semipalmated Sandpiper	SESA	*Calidris pusilla*	SMSHORE
Short-billed Dowitcher	SBDO	*Limnodromus griseus*	SMSHORE
Snowy Plover	SNPL	*Charadrius alexandrinus*	SMSHORE
Spotted Sandpiper	SPSA	*Actitis macularia*	SMSHORE
Unidentified Dowitcher	DOWI	*Limnodromus* spp.	SMSHORE
Unidentified peeps	PEEP	*Calidris* spp.	SMSHORE
Western Sandpiper	WESA	*Calidris mauri*	SMSHORE
Western Sandpiper or Dunlin	WESA/DUNL	*Calidris* spp.	SMSHORE
Western Sandpiper or Least Sandpiper	WESA/LESA	*Calidris* spp.	SMSHORE
Arctic Tern	ARTE	*Sterna paradiaea*	TERN
Black Tern	BLTE	*Chlidonias niger*	TERN
Caspian Tern	CATE	*Sterna caspia*	TERN
Common Tern	COTE	*Sterna hirundo*	TERN
Elegant Tern	ELTE	*Sterna elegans*	TERN
Forster's Tern	FOTE	*Sterna forsteri*	TERN
Least Tern	LETE	*Sterna antillarum browni*	TERN
Unidentified tern	TERN	*Sterna* spp.	TERN

Appendix II

Supplementary surveys of known California Gull breeding colonies have been carried out by SFBBO during the late incubation and early hatching period in May of each year (this year, from May 13–25). Surveyed sites were A1, the A5/A7/A8 levee, A9, AB2, the M1/M2 levee, the M4/M5 levee, the N2A/N3A levee, the N6/N7 levee, RSF2, and the Palo Alto Flood Control Channel (PAFCC; outside of the Salt Pond Survey area). Once in the colony, teams of observers systematically walked through the colony and counted all active nests present. Empty or fully depredated nests were excluded. Some parts of colonies or sites could not be safely accessed due to pond conditions (e.g., low water levels preventing kayaking) or concerns of encouraging predation of co-nesting species. In these cases, active nest numbers were estimated from the closest possible vantage point within the colony. The final nest counts were then multiplied by two birds per nest to produce an estimate of the adult breeding population.

Table A3.1. Number of active nests in breeding colonies of California Gulls within South San Francisco Bay, 2013–2023. "-" indicates a colony was not surveyed in that year, often but not always because it was believed to be inactive. No surveys were conducted in 2020 due to the COVID-19 pandemic. The total number of breeding adults was estimated as twice the number of counted nests. Colonies include A1, A5/A7/A8, A9/A10/A11/A14, AB2, M1/M2, M4/M5, N2A/N3A/N4AB, N6/N7/N8/N9, RSF2, and the Palo Alto Flood Control Channel (PAFCC); labeled based on lowest numbered site.

Site	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
A1	142	208	208	175	121	89	1	-	0	-	0
A5	128	194	0	0	1197	3221	3144	-	3435	3338	3054
A9	8404	7347	6698	5290	5122	1776	66	-	1	-	-
AB2	68	43	80	145	275	173	339	-	280	1334	2350
M1	669	724	967	826	1424	828	675	-	1702	1761	1104
M3	2572	2518	1673	1250	210	1752	1868	-	3060	2205	0
M4	1749	1897	2590	2279	2742	2479	2531	-	423	52	1489
N2A	3219	3043	1209	1024	699	1224	1210	-	1763	2284	1799
N6	3560	4041	4231	3318	2795	4030	4279	-	3554	2419	3534
PAFCC	7264	7512	7236	6879	8446	9997	9225	-	9402	10138	8879
RSF2	-	-	-	-	-	-	-	-	-	45	641
Total Nests	**27775**	**27527**	**24892**	**21186**	**23031**	**25569**	**23338**	-	**23620**	**23576**	**22850**
Breeding Adults	**55550**	**55054**	**49784**	**42372**	**46062**	**51138**	**46676**	-	**47240**	**47152**	**45700**