SAN FRANCISCO BAY
BIRD OBSERVATORY

South Bay Salt Pond Waterbird Surveys
September 2021 – May 2022

Prepared By:

Gabbie Burns, Science Director
San Francisco Bay Bird Observatory
524 Valley Way, Milpitas CA 95035

Prepared For:

Dave Halsing, Executive Project Manager, and Donna Ball, Lead Scientist
South Bay Salt Pond Restoration Project
State Coastal Conservancy

Rachel Tertes, Wildlife Biologist
Don Edwards San Francisco Bay National Wildlife Refuge
U.S. Fish & Wildlife Service

John Krause, Reserve Manager
Eden Landing Ecological Reserve
California Department of Fish and Wildlife

Amy Larson
California Wildlife Foundation

Laura Cholodenko
California State Coastal Conservancy

FINAL REPORT
October 12, 2022

Suggested citation: Burns, G. 2022. South Bay Salt Pond Waterbird Surveys: September – May 2022. Report prepared for the South Bay Salt Pond Restoration Project.

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 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 (CDFW), 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 2021 and May 2022.

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 ponded wetland habitats. As the SBSPRP proceeds, understanding how waterbirds use ponds, identifying key habitat associations, and incorporating features essential to pond-dependent species into restoration plans will be increasingly important to maintain baseline numbers of waterbirds in the South Bay.

From September 2021 – May 2022, 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 also put these waterbird counts in the context of long-term trends to assess changes in waterbird numbers relative to baseline counts from before marsh restoration.

We recorded 1,248,069 waterbird observations of 78 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 6 out of 10 species/guilds has increased in SBSPRP ponds since prior to restoration activities in 2005 – 2007. Exceptions comprise phalaropes, Bonaparte's gulls, dabbling ducks, medium shorebirds. Bonaparte's gull counts declined by 84% which exceeds the threshold of a 50% decline in a single year.

As the SBSPRP progresses, we recommend a precautionary approach to waterbird management and tidal marsh restoration and maintenance of enough of the ponds within the project footprint to provide a variety of salinity and water levels suitable for many different guilds. Special consideration should be given to birds that traditionally prefer medium to high salinity ponds, such as phalaropes and Eared Grebes, since restoration activities have already reduced the prevalence of these habitat conditions and the remaining high salinity habitat is managed for salt production rather than waterbird needs. Creating or maintaining islands or undisturbed levees will provide additional nesting and roosting habitat for other guilds. As the restoration advances, continued monitoring of avian use of Cargill-managed and SBSPRP ponds will be valuable in assessing progress toward the management target of maintaining baseline waterbird numbers. However, a regional perspective will be needed to tease apart drivers of waterbird use in the project area. With more than a decade of bird and water quality monitoring data available, a useful next step will be to model bird habitat use and to use the model to predict the impact of future restoration scenarios on bird abundance.

List of Tables

List of Figures

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 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). Surveys beginning in September 2021 were conducted twice in the fall, winter, and spring at all 82 ponds. As the SBSPRP proceeds, understanding how waterbirds use managed ponds, restoration sites and salt production ponds, identifying key habitat associations, and incorporating features needed by marsh or pond-dependent species into restoration design plans will be increasingly important in maintaining numbers of waterbirds in the South Bay.

This report summarizes the results of SFBBO's surveys in the South San Francisco Bay pond complexes from September 2021 to May 2022 (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 visible to surveyors. 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 2022 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.

We sampled water quality separately at 79 ponds (excluded ponds with inaccessible water quality points are A8W, E8AE, E8AW) each survey period. 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 2021 to May 2022.

Abundance

We calculated abundance as the sum of all bird sightings for each species or guild encountered across all surveys from September 2021 to May 2022. 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. 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 September 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.

Methods Changes in 2021

- A19 surveys were conducted from the Newby Island Landfill, which substantially increased the area visible to surveyors. Due to the distance, we fell back to guild-level identification (e.g. dabbling duck, gull, shorebird) more often than we typically due during ground-level surveys.
- Levees around the circumferences M1, M2, and M3 were fully drivable after being inaccessible for a number of years. This increased the visibility for much of the pond area and improved ability to identify birds to the species-level.

Results & Discussion

Overall, we recorded 1,248,069 waterbird sightings of 78 species in the Alviso, Coyote Hills, Dumbarton, Eden Landing, Mowry, and Ravenswood pond complexes from September 2021 to May 2022 (Table 3, Figure 1). The Alviso complex supported the highest overall bird count and the Alviso complex had the highest species richness. The lowest overall bird count occurred in the Dumbarton complex, and lowest species richness was found in the Dumbarton complex. Most guilds showed patchy abundance distributions (Figure 2 – Figure 12), suggesting differential use of habitat within and between ponds. This is consistent with findings of previous SFBBO reports examining waterbird use of Cargill-managed ponds (e.g., Murphy et al. 2007, Robinson-Nilsen et al. 2009, Robinson-Nilsen and Demers 2012b, Donehower et al. 2013). 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 28 b) 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 a larger landscape context will be needed for separating annual variation and site-level changes from population-level phenomena.

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, (Figure 31). Ponds A19, A17, and A6S were the least saline ponds monitored in the study area, while ponds R2, A15, and R5S were the most saline (Figure 29 – Figure 32). 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 29 – Figure 36). 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 (Figure 37 – Figure 40). pH values tended to vary between ponds, and do not tend to show seasonal fluctuations (Figure 41 – Figure 44). 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, 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.

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. More study is needed to examine the guild-specific ranges of tolerance for each water quality parameter.

Alviso

Species Richness, Abundance, and Behavior.

From September 2021 to May 2022, we documented 561,947 sightings of 69 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 45% of all sightings and comprised 36.4% of the total study area (Table 3). Pond A3N was the most used pond in Alviso based on overall bird counts (100,162 sightings). Compared to other complexes, the Alviso ponds supported the highest proportion of terns (41.7%), herons and egrets (51.2%), gulls (49.7%), fisheaters (60.2%), diving ducks (69.2%), and dabbling ducks (64.1%) (Figure 49).

Water Quality.

Average salinities in the Alviso complex ranged from 5.54 ppt (A19, winter) to 297.25 ppt (A15, fall) (Figure 29). 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 29). Temperature followed the general expected seasonal pattern and was also likely influenced by salinity and by time of day (Figure 33). Average dissolved oxygen concentrations ranged from a low of 3.71 mg/L (A22, spring) to a high of 52.87 mg/L (A7, spring) (Figure 37). Average pH values ranged from a low of 4.6 in A23 in winter to a high of 9.13 in A8S in winter, and generally did not display strong seasonal patterns (Figure 41). Staff gauge levels ranged in the Alviso complex from -2.8 ft at A3W in winter, to 8 ft in A17 in winter (Figure 45). Staff gauges are not present in several ponds in the Alviso complex: A10, A11, A19, A22, A23, A2E, A6S, A8, A8S, A8W. Ponds A22, A23, A8, AB2, A19, A23, A6S were dry, inaccessible, or 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 2021 to May 2022, we documented 53,693 sightings of 59 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 4.3% 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 (12,629 sightings). Compared to other complexes, the Coyote Hills ponds supported the highest proportion of no guilds (Figure 49).

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 31.57 ppt (N1A, winter) to 79.8 ppt (N6, spring) (Figure 31). All ponds followed a similar seasonal pattern with the minimum in winter and a maximum generally in summer or fall (Figure 31). 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 0.75 mg/L (N6, fall) to a high of 14.69 mg/L (N4B, spring) (Figure 39). Average pH values ranged from a low of 7.55 in N4AB in winter to a high of 8.89 in N7 in fall and generally did not display strong seasonal patterns (Figure 43). Staff gauge levels ranged from 0.9 ft at N7 in spring, to 5.8 ft in N1A in spring (Figure 47). Staff gauges are not present in the following ponds in the Coyote Hills complex: N4AB, N4B.

Dumbarton

Species Richness, Abundance, and Behavior.

From September 2021 to May 2022, we documented 44,272 waterbird sightings of 46 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 3.5% of all waterbird sightings and comprised 6.3% of the total study area (Table 3). Pond N1 was the most used based on overall bird counts (17,141 sightings). Compared to other complexes, the Dumbarton ponds supported the highest proportion of no guilds (Figure 49).

Water Quality.

The Dumbarton complex was characterized by moderate salinities, and salinity tended to increase as water moved east within the system (Figure 31). Average salinities ranged from 58.62 ppt at N3 in fall to 174.5 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 31). 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 4.63 mg/L (N1, fall) to a high of 10.33 mg/L (N1, fall) (Figure 39). Average pH values ranged from a low of 7.45 in N1 in spring to a high of 8.7 in N1 in winter and generally did not display strong seasonal patterns (Figure 43). Staff gauge levels ranged from 0.8 ft at N1 in spring, to 3.8 ft in N3 in winter (Figure 47). Staff gauges are present and functional on all ponds in the Dumbarton complex except NPP1.

Eden Landing

Species Richness, Abundance, and Behavior.

From September 2021 to May 2022, we documented 332,999 waterbird sightings of 64 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 26.7% of all sightings and comprised 22.6% of the total study area (Table 3). Pond E6A was the most used based on overall bird counts (45,008 sightings). Compared to other complexes, the Eden Landing ponds supported the highest proportion of small shorebirds (36.9%), phalaropes (46.5%), and medium shorebirds (34.7%) (Figure 49).

Water Quality.

The Eden Landing complex was characterized by mostly low to moderate salinities, with one high salinity pond (E6C) (Figure 30). Average salinities ranged from 15.87 ppt at E2C in winter to 261 ppt at E6C in spring. 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 34). Average dissolved oxygen concentrations ranged from a low of 2.37 mg/L (E11, winter) to a high of 46.02 mg/L (E2, spring) (Figure 38). Average pH values ranged from a low of 7.1 in E6C in spring to a high of 9.12 in CP3C in fall and generally did not display strong seasonal patterns (Figure 42). Staff gauge levels ranged from 0.6 ft at E11 in spring, to 7.3 ft in E12 in winter (Figure 46). Staff gauges are not present in the following ponds at the Eden Landing complex: E4C, E6, E7, E8AE, E8AW.

Mowry

Species Richness, Abundance, and Behavior.

From September 2021 to May 2022, we documented 121,611 waterbird sightings of 51 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 9.7% of all waterbird sightings and comprised 14.4% of the total study area (Table 3). Pond M3 was the most used based on overall bird counts (48,085 sightings). Compared to other complexes, the Mowry ponds supported the highest proportion of eared grebes (82%) (Figure 49).

Water Quality.

The Mowry complex it typically characterized by moderate to high salinity ponds, although M1 and M2 were borderline low salinity this year (Figure 31). Average salinities ranged from 64.46 ppt at M1 in fall to 290.33 ppt at M6 in fall. This complex sees less of a seasonal swing in salinities, but still tended to have lowest salinities in winter and highest in the summer. 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 2.75 mg/L (M3, fall) to a high of 298.06 mg/L (M1, winter) (Figure 39). Average pH values ranged from a low of 7.13 in M6 in fall to a high of 8.79 in M1 in spring and generally did not display strong seasonal patterns (Figure 43). Staff gauge levels ranged from 1.7 ft at M4 in spring, to 3.5 ft in M1 in winter (Figure 47).

Ravenswood

Species Richness, Abundance, and Behavior

From September 2021 to May 2022, we documented 133,547 waterbird sightings of 54 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 10.7% 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 (62,771 sightings). Compared to other complexes, the Ravenswood ponds supported the highest proportion of no guilds (Figure 49).

Water Quality

The Ravenswood complex was characterized by three low salinity ponds (RSF2U1, U2 and U4) and seven high salinity ponds (Figure 32). 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 25.37 ppt at RSF2U1 in winter to 328.5 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 36). Average dissolved oxygen concentrations ranged from a low of 2.86 mg/L (RSF2U4, spring) to a high of 14.25 mg/L (R1, winter) (Figure 40). Average pH values ranged from a low of 5.14 in R5S in fall to a high of 8.89 in R1 in winter and generally did not display strong seasonal patterns (Figure 44). Staff gauge levels ranged from often dry on ponds R1-R2 to 6 ft in RSF2U2 in fall (Figure 48). Staff gauges are always dry or inaccessible on ponds R3, R4, R5 and R5S.

Guilds

Dabblers

Across all complexes, a total of 163,489 dabbling ducks were observed during the survey period. By complex, abundance of dabbling ducks was highest in Alviso ponds A16, A9, and A2E; Coyote Hills pond N4AB; Dumbarton pond N1; Eden Landing ponds E6A and E4; Mowry pond M3; and Ravenswood pond RSF2U2 (Table 5, Figure 3, Figure 19). Over all complexes, A16 had the highest total count (24,446 observations), followed by A9 (13,965) and A2E (12,130). At Ponds A16, A9, and A2E, we observed the majority of dabbling ducks roosting (50.4%), roosting (59.6%), and roosting (63.6%), 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 208,196 diving ducks were observed during the survey period. By complex, abundance of diving ducks was highest in Alviso ponds A2W, A3W, and A2E; Coyote Hills pond N4AB; Dumbarton pond N1; Eden Landing ponds E2 and E10; Mowry pond M3; and Ravenswood pond R1 (Table 6, Figure 4, Figure 20). Over all complexes, A2W had the highest total count (26,205 observations), followed by A3W (21,520) and A2E (14,294). At Ponds A2W, A3W, and A2E, we observed the majority of diving ducks roosting (97.3%), roosting (89%), and roosting (83.8%), 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 a significant decrease in abundance with increase in temperature (Scullen et al. 2013). Across all complexes, a total of 34,956 eared grebes were observed during the survey period. By complex, abundance of eared grebes was highest in Alviso ponds A13, A5, and A14; Coyote Hills pond N4AA; Dumbarton pond N1; Eden Landing ponds E2 and E5; Mowry pond M3; and Ravenswood pond R1 (Table 7, Figure 5, Figure 21). Over all complexes, M3 had the highest total count (15,442 observations), followed by M4 (11,708) and A13 (1,424). At Ponds M3, M4, and A13, we observed the majority of eared grebes roosting (72.1%), roosting (64.7%), and roosting (57.2%), respectively (Table 7).

Fisheaters

Across all complexes, a total of 22,342 fisheaters were observed during the survey period. By complex, abundance of fisheaters was highest in Alviso ponds A7, A5, and A14; Coyote Hills pond N3A; Dumbarton pond N3; Eden Landing ponds E7 and E2; Mowry pond M3; and Ravenswood pond RSF2U2 (Table 8, Figure 6, Figure 22). Over all complexes, A7 had the highest total count (1,996 observations), followed by A5 (1,982) and A14 (1,683). At Ponds A7, A5, and A14, we observed the majority of fisheaters on levee (87.3%), on levee (80.4%), and on levee (53.8%), 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. Previous reports showed that fisheaters showed a significant increase in abundance with increases in staff gauge values (ie, higher water levels), and a significant decrease in abundance with increases in dissolved oxygen or salinity (Scullen et al. 2013).

Gulls

Across all complexes, a total of 85,065 gulls were observed during the survey period. By complex, abundance of gulls was highest in Alviso ponds A7, A15, and A5; Coyote Hills pond N3A; Dumbarton pond N3; Eden Landing ponds CP3C and E6A; Mowry pond M3; and Ravenswood pond R2 (Table 9, Figure 7, Figure 23). Over all complexes, A7 had the highest total count (9,937 observations), followed by M3 (8,981) and A15 (5,604). At Ponds A15, M3, and A7, we observed the majority of gulls roosting (99.1%), on islands (64.1%), and on levee (86.1%), 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. The presence of gulls on levees in the spring is largely due to summer breeding colonies. In recent breeding seasons, we observed breeding California Gull colonies on levees and islands at A5, A7, A8, A8S, A8W, AB2, N2A, N3A, N4AB, N6, N7, N8, N9, M1, M2, M3, M4, M5, M6, and RSF2. In 2022, 45,442 California Gulls were estimated to be breeding in the South San Francisco Bay, although this species is present along with 7 other gull species during the winter months as well (Burns 2022).

Herons and Egrets

Across all complexes, a total of 3,019 herons and egrets were observed during the survey period. By complex, abundance of herons and egrets was highest in Alviso ponds A16, A11, and A14; Coyote Hills pond N1A; Dumbarton pond N3; Eden Landing ponds E2 and E7; Mowry pond M1; and Ravenswood pond RSF2U1 (Table 10, Figure 8, Figure 24). Over all complexes, A16 had the highest total count (175 observations), followed by A11 (151) and E2 (145). At Ponds A16, A11, and E2, we observed the majority of herons and egrets foraging (78.9%), foraging (68.2%), and foraging (75.2%), 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, 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 better (or simply a larger area of) foraging habitat.

Medium Shorebirds

Across all complexes, a total of 144,115 medium shorebirds were observed during the survey period. By complex, abundance of medium shorebirds was highest in Alviso ponds A9, AB1, and A3N; Coyote Hills pond N4; Dumbarton pond N1; Eden Landing ponds E11 and E9; Mowry pond M1; and Ravenswood pond RSF2U1 (Table 11, Figure 9, Figure 25). Over all complexes, A9 had the highest total count (14,160 observations), followed by E11 (13,505) and RSF2U1 (11,018). At Ponds A9, E11, and RSF2U1, we observed the majority of medium shorebirds roosting (72.3%), roosting (87.5%), and on islands (74.3%), respectively (Table 11). 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). They were also found foraging in grids with islands and roosting near levees. Therefore, the presence of roosting islands or levees that are closed to public access and adjacent to quality foraging mudflat habitat are integral for shorebirds in ponds.

Phalaropes

Across all complexes, a total of 940 phalaropes were observed during the survey period. By complex, abundance of phalaropes was highest in Alviso ponds A13, NA, and NA; Coyote Hills pond N4; Dumbarton pond NPP1; Eden Landing ponds E2 and E10; Mowry pond M1; and Ravenswood pond R1 (Table 12, Figure 10, Figure 26). Over all complexes, E2 had the highest total count (250 observations), followed by NPP1 (211) and E10 (153). At Ponds E2, NPP1, and E10, we observed the majority of phalaropes foraging (100%), foraging (100%), and foraging (100%), respectively (Table 12). 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). 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).

Small Shorebirds

Across all complexes, a total of 577,934 small shorebirds were observed during the survey period. By complex, abundance of small shorebirds was highest in Alviso ponds A3N, A9, and A15; Coyote Hills pond N9; Dumbarton pond NPP1; Eden Landing ponds E4C and E6A; Mowry pond M2; and Ravenswood pond R1 (Table 13, Figure 11, Figure 27). Over all complexes, A3N had the highest total count (93,000 observations), followed by R1 (51,701) and R2 (39,101). At Ponds A3N, R1, and R2, we observed the majority of small shorebirds roosting (92.3%), roosting (73.5%), and roosting (66.6%), 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). As noted for medium shorebirds, islands and levees in the ponds may offer high tide refugia for shorebirds in the San Francisco Bay. 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 7,197 terns were observed during the survey period. By complex, abundance of terns was highest in Alviso ponds A16, AB2, and A14; Coyote Hills pond N8; Dumbarton pond N3; Eden Landing ponds E7 and E2; Mowry pond M1; and Ravenswood pond RSF2U2 (Table 14, Figure 12, Figure 28). Over all complexes, E7 had the highest total count (1,221 observations), followed by RSF2U2 (808) and A16 (692). At Ponds A16, RSF2U2, and E7, we observed the majority of terns roosting (71.7%), on islands (83.2%), and on manmade structures (93.1%), respectively (Table 14). Previous reports found that terns were most abundant in large ponds with lower salinity (De La Cruz et al. 2018).

Long-term Trends

The most recent three-year averages of waterbird counts from surveys that included all ponds (excluding March 2020 - February 2021) exceeded the SBSPRP baseline values for 6 out of 10 species/guilds (Table 15, Figure 50, Figure 51). Ruddy ducks have more than doubled, while diving ducks (also includes Ruddy Ducks) and small shorebirds (in fall and spring) have increased by over 40%. Eared grebes and Least terns showed smaller increases.

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 SBSPRP ponds are supporting fewer Eared Grebes than prior to the SBSPRP.

Four species/guilds showed negative trends in counts: dabbling ducks, medium shorebirds, Bonaparte’s Gulls, and phalaropes. Medium shorebirds in spring have declined by 8%, suggesting that their numbers are close to baseline values. Dabbling ducks have declined by 28% and they do not have a set action threshold. Bonaparte’s Gulls have declined by 84% which exceeds the threshold of a 50% decline and counts have not yet reached a trigger (Table 15). Phalarope numbers have declined by 78%. Phalarope counts reached a trigger and crossed a NEPA/CEQA significance threshold in 2017 (the most recent year of summer surveys at all ponds). Targeted phalarope surveys in the summer and fall are helping to more accurately characterize SBSPRP site use by phalaropes. NEPA/CEQA significance thresholds require that a decline is due to restoration activities. The cause of the declines in phalaropes cannot be attributed to restoration activities without further investigation of phalarope population trends outside of the SBSPRP area and/or South San Francisco Bay. New surveys across the Pacific Flyway will make it possible to compare local phalarope counts to those at other staging sites (Carle et al. 2021).

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. Analyses considering both Cargill-managed ponds and SBSPRP areas together was a first step that we incorporated into the long-term trend analysis. The lack of inverse trends in the abundance of birds at SBSPRP sites and Cargill-managed sites indicates that changes in numbers may be driven by factors operating on larger geographic scales, for example, at the scale of San Francisco Bay or the Pacific Flyway (Murphy et al. 2007).

Restored ponds become more difficult to survey as accessibility decreases and vegetation increases, obscuring distant birds from view. To meet the goal of surveying birds at restored sites as tidal marsh habitat reestablishes, it will inevitably become necessary to employ alternative survey strategies. We recommend that efforts are put forward to investigate alternative monitoring methods, such as aerial surveys using Unoccupied Aerial Vehicles. Employing a new method requires initial assessments to investigate survey impacts on birds, the feasibility of using aerial photographs to identify bird species, and establishment of a correction factor for converting between ground- and aerial-based counts.

Given the decline in Bonaparte's gull counts, special attention should be paid to how the trend continues during 2022 surveys. Analysis of past Bonaparte's gull salt pond data should be considered to better understand their salt pond usage and migration trends.

In recent years, the topic of local bird movement and its effect on our ability to assess true waterbird abundance within the ponds has generated some interesting discussion among agency, academic, and nonprofit biologists, statisticians, and resource professionals. Currently, we (SFBBO and other entities) do not have the ability to quantify local bird movement in time and space through our ground count methodology, as pond ground counts are not conducted on the same day due to staff, equipment, and other resource constraints. Nevertheless, quantifying bird movement would seem a valuable addition in determining how closely ground counts reflect true waterbird abundance. We would recommend repeated, staggered counts of the same ponds conducted on the same day by the same observer be performed to address this issue and to determine if a correction factor should be applied to ground counts to better approximate true waterbird abundance.

Another avenue of investigation into bird movement is to take advantage of recently installed Motus towers around the South Bay. As more birds tagged at other sites migrate through the Bay Area, we can analyze their location date to understand movements around the South Bay. Future research could target key species of interest and undertake tagging projects.

We 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.

With more than a decade of waterbird and water quality monitoring data available, we suggest support of an effort to model bird site use as a function of site characteristics and habitat availability. This model should be used to predict bird use of sites under alternative future restoration 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.

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 Eared Grebes. Consider

managing ponds to support use by phalaropes, 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. Maintain some flooded units during the winter months for diving duck populations, especially more pond dependent species, like Ruddy Duck

4. Continue monitoring waterbird use of Cargill-managed and SBSPRP ponds as the project proceeds with its restoration activities. Attention should be given to alternative methods to monitor restored sites to understand bird use following restoration to tidal marsh habitat.

Acknowledgements

Thank you to the California Wildlife Foundation, the U.S. Fish & Wildlife Service, the California State Coastal Conservancy, and the Santa Clara Valley Water District (Valley Water) for coordinating and funding this work. We would like to thank Cheryl Strong, Rachel Tertes, and Matt Brown at the Refuge for past and present help with coordination and guidance for these surveys. We would like to acknowledge the South Bay Salt Pond Restoration's Pond Management Working Group that has recommended and implemented many management changes over the years as they relate to specific pond systems. Thank you to Dave Halsing and Donna Ball of the South Bay Salt Pond Restoration Project; John Krause with the CDFW Eden Landing Ecological Reserve; Susan De La Cruz, Lacy Smith and Stacy Moskal with the U.S. Geological Survey; and Laura Cholodenko with the Coastal Conservancy. We could not have done this work without our dedicated field crew: Parker Kaye, Angela Petrice, Katie LaBarbera, Sirea Lao, Lori Liu, Josh Scullen, Dan Wenny, Cole Jower, Kaili Hovind. Thank you also to SFBBO staff, Katie LaBarbera, Parker Kaye, and Angela Petrice for their logistical support with surveys and their work on earlier drafts of this report.

Literature Cited

Accurso, L. M. 1992. Distribution and abundance of wintering waterfowl on San Francisco Bay 1988-1990. Master's Thesis. Humboldt State University, Arcata, CA.

Anderson, W. 1970. A preliminary study of the relationship of salt ponds and wildlife – South San Francisco Bay. California Fish and Game 56: 240–252.

Brand, L. A, J. Y. Takekawa, J. Bluso-Demers, E. Mruz, J. Krause, and C. Strong. 2011. Shorebird and duck responses to pond management in the South Bay salt ponds. Invited presentation. South Bay Science Symposium 2011: Phase 1 Restoration of the South Bay. February 3, 2011. Menlo Park, CA.

Burns, G. 2022. Community Science-based Colonial Waterbird Monitoring: 2022 Nesting Summary. Unpublished report. San Francisco Bay Bird Observatory, Milpitas, CA.

Cameron, A. C., and P. Trivedi. 2013. Regression analysis of count data. Volume 53. Cambridge University Press. Cambridge, UK.

Carle, R., Burns, G., Hecocks, S. et al. 2021. Coordinated phalarope surveys at western North American staging sites, 2019-2020. Report. https://www.sfbbo.org/uploads/1/1/6/7/116792187/phalaropes_staging_sites_report_final.pdf

Carpelan, L. H. 1957. Hydrobiology of the Alviso salt ponds. Ecology 38: 375-390.

Cullen, S. A., J. R. Jehl, Jr., and G. L. Nuechterlein. 1999. Eared Grebe (Podiceps nigricollis). In Birds of North America, No. 433 (A. Poole and F. Gill, Eds.). The Birds of North America, Inc., Philadelphia, PA.

De La Cruz, S.E.W., L.M. Smith, S.M. Moskal, C. Strong, J. Krause, Y. Wang, and J.Y. Takekawa, 2018, Trends and habitat associations of waterbirds using the South Bay Salt Pond Restoration Project, San Francisco Bay, California: U.S. Geological Survey Open-File Report 2018–1040, 136 p., https://doi.org/10.3133/ofr20181040.

Donehower, C., J. Scullen, K. Tokatlian. 2013. Salt Pond Waterbird Surveys Data Summary, October 2011 – September 2012. Unpublished report. San Francisco Bay Bird Observatory, Milpitas, CA.

Murphy, A., C. Strong, D. Le Fer, and S. Hudson. 2007. Interim Cargill salt pond report. Unpublished report. San Francisco Bay Bird Observatory, Milpitas, CA.

Page, G. W., L. E. Stenzel, and C. M. Wolfe. 1999. Aspects of the occurrence of shorebirds on a central California estuary. Studies in Avian Biology 2: 15–32.

R Development Core Team. 2018. R: A language and environment for statistical computing. version 3.5.1. Vienna, Austria: R Foundation for Statistical Computing. Retrieved from http://www.r-project.org

Robinson-Nilsen, C., J. Demers, and S. Scott. 2009. Cargill pond waterbird surveys report 2005-2008. Unpublished report. San Francisco Bay Bird Observatory, Milpitas, CA.

Robinson-Nilsen, C. and J. Bluso-Demers. 2012a. California Gull breeding surveys and hazing project. Unpublished report. San Francisco Bay Bird Observatory, Milpitas, CA.

Robinson-Nilsen, C. and J. Bluso-Demers. 2012b. Salt pond waterbird surveys report, October 2010-September 2011. Unpublished report. San Francisco Bay Bird Observatory, Milpitas, CA.

Scullen, J., E. Taketa, and C.E. Burns. 2013. Salt Pond Waterbird Surveys Data Summary, September 2012 – August 2013. Unpublished report. San Francisco Bay Bird Observatory, Milpitas, CA.

Takekawa, J. Y., C. T. Lu, and R. T. Pratt. 2001. Bird communities in salt evaporation ponds and baylands of the northern San Francisco Bay estuary. Hydrobiologia 466: 317–328.

Takekawa, J. Y., A. K. Miles, D. H. Schoellhamer, N. D. Athearn, C. Jannusch, M. K. Saiki, W. D. Duffy, and S.

Kleinschmidt. 2006. Trophic structure and avian communities across a salinity gradient in evaporation ponds of the San Francisco Bay estuary. Hydrobiologia 567: 307-327.

Tarjan, L.M. and V. Heyse. 2018. Evaluation of Waterbird Monitoring Protocols for the South Bay Salt Pond Restoration Project. Report prepared for the South Bay Salt Pond Restoration Project Management Team.

Tarjan, L.M. 2019. Migration timing and spatial distribution of phalaropes in San Francisco Bay. Report prepared for the South Bay Salt Pond Restoration Project Management Team.

Tarjan, L.M. 2021. Trends in waterbird counts in south San Francisco Bay. Report prepared for the South Bay Salt Pond Restoration Project Management Team.

Tarjan, L.M. and G. Burns. 2021a. South Bay Salt Pond Waterbird Surveys: September 2019 - February 2021. Report prepared for the South Bay Salt Pond Restoration Project Management Team.

Tokatlian, K., K. Butler and C.E. Burns. 2014. Citizen Science-based Colonial Waterbird Monitoring: 2014 Nesting Summary. Unpublished report. San Francisco Bay Bird Observatory, Milpitas, CA.

Velasquez, C. 1992. Managing artificial saltpans as a waterbird habitat: species' response to water level manipulation. Colonial Waterbirds 15: 43-55.

Ver Planck, W. E. 1958. Salt in California. California Division of Mines Bulletin, No. 175.

Warnock, N., G. W. Page, T. D. Ruhlen, N. Nur, J. Y. Takekawa, and J. T. Hanson. 2002. Management and conservation of San Francisco Bay salt ponds: effects of pond salinity, area, tide, and season on Pacific Flyway waterbirds. Waterbirds 25: 79–92.

Wickham, H. 2016. ggplot2: Elegant Graphics for Data Analysis. Springer-Verlag New York.

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
138	fall	September 2021	2021-09-01	2021-10-12
139	fall	October 2021	2021-10-15	2021-11-19
140	winter	December 2021	2021-12-01	2022-01-13
141	winter	January 2022	2022-01-17	2022-02-25
142	spring	March 2022	2022-03-01	2022-04-12
143	spring	April 2022	2022-04-15	2022-05-27

Table 2. List of all ponds surveyed, their staff gauge location, and staff gauge status in 2022. 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	Inaccessible due to construction since Spring 2022
	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	GOOD	
	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	Inaccessible for first part of year, restored

Table 2. List of all ponds surveyed, their staff gauge location, and staff gauge status in 2022. Ponds marked with a '*' symbol are tidal.

Complex	Pond	Grid	Status	Notes
Coyote Hills	N1A	C8	BROKEN	Water control structure w/ SG is broken and crooked
	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

Table 2. List of all ponds surveyed, their staff gauge location, and staff gauge status in 2022. Ponds marked with a '*' symbol are tidal.

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	
	CP3C	B2	GOOD	
	E4	B6	GOOD	
	E4C	NONE	MISSING	Missing since at least 2014
	E5	C6	GOOD	
	E5C	C4	GOOD	
	E6	D8	MISSING	Removed during construction 2020
	E6A	A3	GOOD	
	E6B	A6	GOOD	
	E6C	A4	GOOD	
	E7	B5	MISSING	Removed during construction 2020
	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

Table 2. List of all ponds surveyed, their staff gauge location, and staff gauge status in 2022. Ponds marked with a '*' symbol are tidal.

Complex	Pond	Grid	Status	Notes
Mowry	M1	H10	GOOD	
	M2	G10	GOOD	
	M3	B6	GOOD	
	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), relative percentage of sightings versus area, and most abundant guild by pond complex and individual pond, South San Francisco Bay, California; September 2021 - May 2022.

Complex	Pond	Species Richness	Abundance	Percent of Total Sightings in Survey Area	Percent of Total Acreage in Survey Area	Most Abundant Guild
Alviso	A1	33	6107	0.49	1.38	Divers
Alviso	A10	36	10612	0.85	1.26	Divers
Alviso	A11	46	10026	0.80	1.32	Divers
Alviso	A12	14	4281	0.34	1.55	Gulls
Alviso	A13	31	13267	1.06	1.35	Sm Shore
Alviso	A14	37	23605	1.89	1.71	Divers
Alviso	A15	14	25456	2.04	1.27	Sm Shore
Alviso	A16	52	40046	3.21	1.22	Dabblers
Alviso	A17	38	10293	0.82	0.66	Dabblers
Alviso	A19	29	13644	1.09	1.32	Dabblers
Alviso	A22	18	7763	0.62	1.35	Sm Shore
Alviso	A23	19	10385	0.83	2.25	Gulls
Alviso	A2E	34	27901	2.24	1.60	Divers
Alviso	A2W	35	28755	2.30	2.16	Divers
Alviso	A3N	31	100162	8.03	0.83	Sm Shore
Alviso	A3W	43	31717	2.54	2.82	Divers
Alviso	A5	40	21416	1.72	3.17	Divers
Alviso	A6S	32	20156	1.61	1.38	Sm Shore
Alviso	A7	40	19335	1.55	1.33	Gulls
Alviso	A8	37	7604	0.61	2.04	Divers
Alviso	A8S	40	2973	0.24	0.84	Dabblers
Alviso	A8W	28	493	0.04	0.08	Fish Eaters
Alviso	A9	41	74072	5.93	1.83	Sm Shore

Complex	Pond	Species Richness	Abundance	Percent of Total Sightings in Survey Area	Percent of Total Acreage in Survey Area	Most Abundant Guild
Alviso	AB1	41	20375	1.63	0.76	Med Shore
Alviso	AB2	42	31503	2.52	0.90	Divers
Alviso	**Subtotal**	**69**	**561947**	**45.03**	**36.37**	**Sm Shore**
Coyote Hills	N1A	39	2957	0.24	0.83	Divers
Coyote Hills	N2A	35	4358	0.35	0.84	Gulls
Coyote Hills	N3A	40	12629	1.01	2.07	Gulls
Coyote Hills	N4	31	3437	0.28	1.68	Med Shore
Coyote Hills	N4AA	38	5214	0.42	1.49	Divers
Coyote Hills	N4AB	33	12603	1.01	1.17	Divers
Coyote Hills	N4B	28	2231	0.18	0.32	Sm Shore
Coyote Hills	N5	20	722	0.06	0.95	Sm Shore
Coyote Hills	N6	21	2004	0.16	0.46	Gulls
Coyote Hills	N7	26	1910	0.15	1.88	Gulls
Coyote Hills	N8	26	2474	0.20	0.56	Gulls
Coyote Hills	N9	31	3154	0.25	0.67	Sm Shore
Coyote Hills	**Subtotal**	**59**	**53693**	**4.30**	**12.91**	**Divers**
Dumbarton	N1	26	17141	1.37	1.70	Dabblers
Dumbarton	N2	25	4922	0.39	0.96	Divers
Dumbarton	N3	38	9929	0.80	2.72	Med Shore
Dumbarton	NPP1	24	12280	0.98	0.95	Sm Shore
Dumbarton	**Subtotal**	**46**	**44272**	**3.55**	**6.32**	**Sm Shore**
Eden Landing	E1	32	3834	0.31	1.46	Divers
Eden Landing	E10	35	9348	0.75	1.06	Divers
Eden Landing	E11	29	22590	1.81	0.62	Med Shore

Complex	Pond	Species Richness	Abundance	Percent of Total Sightings in Survey Area	Percent of Total Acreage in Survey Area	Most Abundant Guild
Eden Landing	E12	38	18285	1.47	0.53	Sm Shore
Eden Landing	E13	38	21449	1.72	0.71	Sm Shore
Eden Landing	E14	12	6087	0.49	0.82	Sm Shore
Eden Landing	E1C	19	1910	0.15	0.32	Sm Shore
Eden Landing	E2	44	23144	1.85	3.37	Divers
Eden Landing	E2C	26	4950	0.40	0.14	Sm Shore
Eden Landing	CP3C	32	14621	1.17	0.82	Sm Shore
Eden Landing	E4	36	12608	1.01	0.96	Sm Shore
Eden Landing	E4C	17	33377	2.67	0.87	Sm Shore
Eden Landing	E5	28	13237	1.06	0.82	Sm Shore
Eden Landing	E5C	22	10500	0.84	0.47	Sm Shore
Eden Landing	E6	28	4214	0.34	0.96	Sm Shore
Eden Landing	E6A	41	45008	3.61	1.58	Sm Shore
Eden Landing	E6B	30	23070	1.85	1.40	Sm Shore
Eden Landing	E6C	15	6666	0.53	0.41	Sm Shore
Eden Landing	E7	34	3452	0.28	1.07	Terns
Eden	E8	24	5521	0.44	0.93	Sm Shore

Complex	Pond	Species Richness	Abundance	Percent of Total Sightings in Survey Area	Percent of Total Acreage in Survey Area	Most Abundant Guild
Landing						
Eden Landing	E8AE	20	21435	1.72	0.65	Sm Shore
Eden Landing	E8AW	15	6662	0.53	0.60	Sm Shore
Eden Landing	E8XN	15	430	0.03	0.05	Divers
Eden Landing	E8XS	11	1283	0.10	0.16	Sm Shore
Eden Landing	E9	34	19318	1.55	1.87	Sm Shore
Eden Landing	**Subtotal**	**64**	**332999**	**26.68**	**22.64**	**Sm Shore**
Mowry	M1	40	17293	1.39	2.45	Sm Shore
Mowry	M2	30	24877	1.99	2.39	Sm Shore
Mowry	M3	34	48085	3.85	2.71	Eared Grebes
Mowry	M4	18	19961	1.60	2.64	Eared Grebes
Mowry	M5	13	6096	0.49	2.05	Sm Shore
Mowry	M6	13	5299	0.42	2.20	Sm Shore
Mowry	**Subtotal**	**51**	**121611**	**9.74**	**14.44**	**Sm Shore**
Ravenswood	R1	37	62771	5.03	2.22	Sm Shore
Ravenswood	R2	25	40955	3.28	0.70	Sm Shore
Ravenswood	R3	14	1869	0.15	1.40	Sm Shore
Ravenswood	R4	16	2175	0.17	1.47	Sm Shore
Ravenswood	R5	8	634	0.05	0.15	Med Shore
Ravenswood	R5S	11	111	0.01	0.15	Sm Shore
Ravenswood	RSF2U1	37	14213	1.14	0.28	Med Shore

Complex	Pond	Species Richness	Abundance	Percent of Total Sightings in Survey Area	Percent of Total Acreage in Survey Area	Most Abundant Guild
Ravenswood	RSF2U2	44	8098	0.65	0.41	Med Shore
Ravenswood	RSF2U3	18	1701	0.14	0.44	Sm Shore
Ravenswood	RSF2U4	30	1020	0.08	0.08	Divers
Ravenswood	**Subtotal**	**54**	**133547**	**10.70**	**7.31**	**Sm Shore**
All	**Total**	**78**	**1248069**	**100.00**	**100.00**	**Sm Shore**

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 2021 - May 2022. 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	13.0	83.1	0.0	1.2	2.7	6107
Alviso	A10	15.4	77.5	0.0	7.2	0.0	10612
Alviso	A11	19.4	67.0	0.0	13.6	0.0	10026
Alviso	A12	13.8	53.9	25.5	6.8	0.0	4281
Alviso	A13	41.4	56.3	0.7	1.6	0.1	13267
Alviso	A14	35.9	54.3	0.0	9.8	0.0	23605
Alviso	A15	1.8	98.2	0.0	0.0	0.0	25456
Alviso	A16	33.8	59.1	6.8	0.1	0.3	40046
Alviso	A17	58.2	41.7	0.0	0.1	0.0	10293
Alviso	A19	67.9	31.4	0.5	0.1	0.0	13644
Alviso	A22	31.8	68.1	0.0	0.1	0.0	7763
Alviso	A23	16.5	83.3	0.0	0.2	0.0	10385
Alviso	A2E	22.7	71.9	0.0	4.7	0.7	27901
Alviso	A2W	4.8	90.6	0.0	0.1	4.4	28755
Alviso	A3N	7.4	92.5	0.0	0.0	0.1	100162
Alviso	A3W	26.7	69.8	0.0	0.6	2.9	31717
Alviso	A5	15.9	47.9	0.0	36.1	0.1	21416
Alviso	A6S	82.5	16.5	0.0	0.0	0.9	20156
Alviso	A7	14.6	19.0	2.3	63.9	0.1	19335
Alviso	A8	22.0	53.1	0.2	24.1	0.5	7604
Alviso	A8S	24.5	35.1	0.0	40.3	0.1	2973
Alviso	A8W	14.8	12.0	0.0	73.2	0.0	493
Alviso	A9	30.2	69.3	0.0	0.4	0.0	74072
Alviso	AB1	36.7	60.8	1.0	0.2	1.4	20375
Alviso	AB2	34.8	57.7	4.1	3.0	0.4	31503

Complex	Pond	% Foraging	% Roosting	% Island	% Levee	% Manmade	N
Coyote Hills	N1A	24.3	50.1	0.0	24.7	0.9	2957
Coyote Hills	N2A	20.3	28.2	0.0	51.4	0.1	4358
Coyote Hills	N3A	19.2	40.8	0.0	39.7	0.3	12629
Coyote Hills	N4	41.5	38.1	15.4	4.0	1.0	3437
Coyote Hills	N4AA	46.6	45.3	0.0	5.3	2.7	5214
Coyote Hills	N4AB	25.5	37.0	0.4	36.5	0.6	12603
Coyote Hills	N4B	54.8	33.1	0.0	7.9	4.1	2231
Coyote Hills	N5	28.1	22.6	0.0	47.4	1.9	722
Coyote Hills	N6	18.8	11.8	0.0	69.3	0.1	2004
Coyote Hills	N7	15.1	22.3	0.0	59.5	3.1	1910
Coyote Hills	N8	8.6	18.9	0.0	70.5	2.0	2474
Coyote Hills	N9	38.9	27.5	5.7	27.6	0.3	3154
Dumbarton	N1	47.5	31.0	15.6	0.5	5.5	17141
Dumbarton	N2	42.3	56.5	1.0	0.2	0.0	4922
Dumbarton	N3	56.4	13.7	23.0	5.7	1.2	9929
Dumbarton	NPP1	45.8	36.9	14.6	1.7	0.9	12280
Eden Landing	E1	31.7	63.5	1.1	2.4	1.3	3834
Eden Landing	E10	10.0	87.9	1.6	0.0	0.4	9348
Eden Landing	E11	17.8	81.7	0.0	0.0	0.5	22590
Eden Landing	E12	27.5	38.0	25.1	4.7	4.8	18285
Eden Landing	E13	62.8	29.4	5.4	1.4	1.0	21449
Eden Landing	E14	65.6	34.4	0.0	0.0	0.0	6087
Eden Landing	E1C	87.9	12.1	0.0	0.0	0.0	1910
Eden Landing	E2	33.4	52.6	12.4	1.0	0.6	23144
Eden Landing	E2C	39.5	60.2	0.3	0.0	0.0	4950
Eden Landing	CP3C	55.1	40.1	0.1	0.0	4.6	14621
Eden Landing	E4	47.8	49.2	0.0	1.0	2.0	12608
Eden Landing	E4C	19.8	78.8	0.0	0.0	1.4	33377

Complex	Pond	% Foraging	% Roosting	% Island	% Levee	% Manmade	N
Eden Landing	E5	34.9	63.5	0.0	0.1	1.5	13237
Eden Landing	E5C	17.6	82.3	0.0	0.1	0.0	10500
Eden Landing	E6	65.7	32.8	0.0	0.2	1.3	4214
Eden Landing	E6A	62.8	37.0	0.1	0.0	0.1	45008
Eden Landing	E6B	62.9	37.1	0.0	0.0	0.0	23070
Eden Landing	E6C	59.6	40.2	0.0	0.1	0.1	6666
Eden Landing	E7	33.0	15.6	0.1	2.9	48.4	3452
Eden Landing	E8	53.4	45.8	0.0	0.1	0.8	5521
Eden Landing	E8AE	6.7	93.3	0.0	0.0	0.0	21435
Eden Landing	E8AW	78.3	21.7	0.0	0.0	0.0	6662
Eden Landing	E8XN	40.2	57.7	0.0	2.1	0.0	430
Eden Landing	E8XS	87.1	12.9	0.0	0.0	0.0	1283
Eden Landing	E9	33.0	66.4	0.0	0.2	0.4	19318
Mowry	M1	11.3	30.0	0.0	58.5	0.2	17293
Mowry	M2	2.4	3.9	47.6	46.1	0.0	24877
Mowry	M3	25.1	45.6	22.0	2.3	5.1	48085
Mowry	M4	49.9	40.0	0.0	10.1	0.0	19961
Mowry	M5	59.7	21.9	2.3	14.8	1.4	6096
Mowry	M6	52.6	38.6	0.0	5.0	3.7	5299
Ravenswood	R1	22.9	76.0	0.2	0.8	0.1	62771
Ravenswood	R2	34.8	65.2	0.0	0.0	0.0	40955
Ravenswood	R3	23.2	76.7	0.0	0.1	0.0	1869
Ravenswood	R4	38.8	60.4	0.0	0.8	0.0	2175
Ravenswood	R5	11.5	88.5	0.0	0.0	0.0	634
Ravenswood	R5S	37.8	60.4	0.0	1.8	0.0	111
Ravenswood	RSF2U1	7.7	16.6	64.6	8.9	2.2	14213
Ravenswood	RSF2U2	16.2	18.7	46.7	18.2	0.2	8098
Ravenswood	RSF2U3	49.3	28.0	22.6	0.1	0.0	1701

Complex	Pond	% Foraging	% Roosting	% Island	% Levee	% Manmade	N
Ravenswood	RSF2U4	52.6	46.4	0.0	1.0	0.0	1020

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 2021 - May 2022. 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	53.6	44.8	0.0	0.4	1.2	250
Alviso	A10	42.0	30.7	0.0	27.4	0.0	398
Alviso	A11	28.0	27.2	0.0	44.9	0.0	497
Alviso	A12	0.0	50.0	0.0	50.0	0.0	2
Alviso	A13	41.2	58.8	0.0	0.0	0.0	2721
Alviso	A14	63.1	36.8	0.0	0.0	0.0	8459
Alviso	A16	45.4	50.4	4.2	0.0	0.0	24446
Alviso	A17	51.3	48.7	0.0	0.0	0.0	5474
Alviso	A19	69.5	30.5	0.0	0.0	0.0	8172
Alviso	A22	100.0	0.0	0.0	0.0	0.0	3
Alviso	A2E	29.1	63.6	0.0	7.2	0.1	12130
Alviso	A2W	23.1	74.3	0.0	0.8	1.9	377
Alviso	A3N	68.4	31.6	0.0	0.0	0.0	76
Alviso	A3W	69.8	29.4	0.0	0.0	0.8	6930
Alviso	A5	18.5	35.9	0.0	45.7	0.0	1667
Alviso	A6S	78.8	21.2	0.0	0.0	0.0	1591
Alviso	A7	26.4	5.5	0.0	68.1	0.0	1331
Alviso	A8	57.1	8.3	1.4	32.7	0.5	771
Alviso	A8S	32.9	13.3	0.0	53.9	0.0	1426
Alviso	A8W	20.5	15.2	0.0	64.3	0.0	112
Alviso	A9	40.4	59.6	0.0	0.0	0.0	13965
Alviso	AB1	60.1	36.7	1.8	0.2	1.2	6051
Alviso	AB2	38.7	58.7	2.5	0.0	0.0	7960
Coyote Hills	N1A	71.4	26.2	0.0	2.4	0.0	42
Coyote Hills	N2A	73.6	26.4	0.0	0.0	0.0	273

Complex	Pond	% Foraging	% Roosting	% Island	% Levee	% Manmade	N
Coyote Hills	N3A	29.9	67.3	0.0	2.8	0.0	1580
Coyote Hills	N4	0.0	100.0	0.0	0.0	0.0	4
Coyote Hills	N4AA	79.3	20.7	0.0	0.0	0.0	87
Coyote Hills	N4AB	45.2	36.3	2.1	16.4	0.0	2518
Coyote Hills	N4B	45.9	53.7	0.0	0.0	0.4	497
Coyote Hills	N5	33.3	66.7	0.0	0.0	0.0	3
Coyote Hills	N6	51.4	48.6	0.0	0.0	0.0	70
Coyote Hills	N7	35.7	64.3	0.0	0.0	0.0	14
Coyote Hills	N8	0.0	100.0	0.0	0.0	0.0	17
Coyote Hills	N9	15.2	79.2	1.1	4.5	0.0	178
Dumbarton	N1	79.0	18.3	1.1	1.6	0.0	4834
Dumbarton	N2	88.5	10.5	0.0	0.9	0.0	323
Dumbarton	N3	68.2	29.3	2.4	0.1	0.0	1885
Dumbarton	NPP1	94.6	2.9	2.4	0.0	0.0	1357
Eden Landing	E1	40.6	59.4	0.0	0.0	0.0	493
Eden Landing	E10	69.2	30.0	0.7	0.0	0.0	273
Eden Landing	E11	59.2	40.8	0.0	0.0	0.0	103
Eden Landing	E12	57.6	29.1	0.1	13.3	0.0	1275
Eden Landing	E13	46.9	49.8	0.4	2.9	0.0	1208
Eden Landing	E1C	93.7	6.3	0.0	0.0	0.0	175
Eden Landing	E2	52.6	43.3	0.2	3.8	0.0	1613
Eden Landing	E2C	46.5	51.4	2.1	0.0	0.0	731
Eden Landing	CP3C	59.0	40.9	0.0	0.0	0.0	3082
Eden Landing	E4	46.4	47.5	0.0	0.0	6.2	3506
Eden Landing	E5	42.1	57.9	0.0	0.0	0.0	1202
Eden Landing	E5C	54.2	43.1	0.0	2.8	0.0	72
Eden Landing	E6	51.0	49.0	0.0	0.0	0.0	153
Eden Landing	E6A	49.9	50.1	0.0	0.0	0.0	9003

Complex	Pond	% Foraging	% Roosting	% Island	% Levee	% Manmade	N
Eden Landing	E6B	39.9	60.1	0.0	0.0	0.0	1316
Eden Landing	E6C	13.6	86.4	0.0	0.0	0.0	435
Eden Landing	E7	73.1	25.5	0.1	0.0	1.3	991
Eden Landing	E8	73.5	26.5	0.0	0.0	0.0	1565
Eden Landing	E8AE	90.6	9.4	0.0	0.0	0.0	255
Eden Landing	E8AW	58.6	41.4	0.0	0.0	0.0	29
Eden Landing	E8XN	50.0	50.0	0.0	0.0	0.0	4
Eden Landing	E8XS	74.6	25.4	0.0	0.0	0.0	201
Eden Landing	E9	69.9	30.1	0.0	0.0	0.0	1216
Mowry	M1	13.9	86.1	0.0	0.0	0.0	208
Mowry	M2	6.1	47.0	43.9	3.0	0.0	132
Mowry	M3	18.0	68.9	7.5	5.7	0.0	10827
Mowry	M4	91.8	8.2	0.0	0.0	0.0	73
Mowry	M5	100.0	0.0	0.0	0.0	0.0	24
Mowry	M6	47.9	52.1	0.0	0.0	0.0	48
Ravenswood	R1	56.7	43.3	0.0	0.0	0.0	978
Ravenswood	R2	4.1	95.9	0.0	0.0	0.0	438
Ravenswood	RSF2U1	39.0	11.5	20.0	29.4	0.1	1406
Ravenswood	RSF2U2	48.0	19.4	32.0	0.5	0.0	1879
Ravenswood	RSF2U4	25.0	75.0	0.0	0.0	0.0	84

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 2021 - May 2022. 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	5.8	94.2	0.0	0.0	0.0	4057
Alviso	A10	9.2	90.5	0.0	0.2	0.0	8575
Alviso	A11	15.8	83.3	0.0	0.9	0.0	7319
Alviso	A12	100.0	0.0	0.0	0.0	0.0	7
Alviso	A13	52.9	47.1	0.0	0.0	0.0	3451
Alviso	A14	17.7	82.3	0.0	0.0	0.0	11370
Alviso	A15	0.0	100.0	0.0	0.0	0.0	1
Alviso	A16	17.8	82.0	0.2	0.0	0.0	5938
Alviso	A17	21.4	78.6	0.0	0.0	0.0	538
Alviso	A19	19.3	80.7	0.0	0.0	0.0	150
Alviso	A22	47.2	52.8	0.0	0.0	0.0	36
Alviso	A2E	16.2	83.8	0.0	0.0	0.0	14294
Alviso	A2W	2.7	97.3	0.0	0.0	0.0	26205
Alviso	A3N	19.6	80.4	0.0	0.0	0.0	56
Alviso	A3W	11.0	89.0	0.0	0.0	0.0	21520
Alviso	A5	20.1	79.2	0.0	0.7	0.0	11771
Alviso	A6S	13.0	87.0	0.0	0.0	0.0	216
Alviso	A7	38.5	61.1	0.0	0.4	0.0	4406
Alviso	A8	16.6	83.4	0.0	0.0	0.0	4462
Alviso	A8S	13.0	86.6	0.0	0.3	0.0	867
Alviso	A8W	13.3	86.7	0.0	0.0	0.0	30
Alviso	A9	2.2	97.8	0.0	0.0	0.0	8286
Alviso	AB1	4.1	95.7	0.0	0.2	0.0	2433
Alviso	AB2	20.9	79.1	0.0	0.0	0.0	8148
Coyote Hills	N1A	25.9	74.1	0.0	0.0	0.0	1568

Complex	Pond	% Foraging	% Roosting	% Island	% Levee	% Manmade	N
Coyote Hills	N2A	26.8	73.2	0.0	0.0	0.0	1315
Coyote Hills	N3A	20.2	79.8	0.0	0.0	0.0	3980
Coyote Hills	N4	82.3	17.7	0.0	0.0	0.0	243
Coyote Hills	N4AA	35.1	64.8	0.0	0.1	0.0	3184
Coyote Hills	N4AB	33.0	66.9	0.0	0.1	0.0	5402
Coyote Hills	N4B	19.8	79.7	0.0	0.0	0.4	464
Coyote Hills	N5	94.1	5.9	0.0	0.0	0.0	85
Coyote Hills	N6	5.8	94.2	0.0	0.0	0.0	103
Coyote Hills	N7	20.8	79.2	0.0	0.0	0.0	24
Coyote Hills	N8	100.0	0.0	0.0	0.0	0.0	2
Coyote Hills	N9	2.9	97.1	0.0	0.0	0.0	209
Dumbarton	N1	37.5	62.5	0.0	0.0	0.0	4081
Dumbarton	N2	78.9	21.1	0.0	0.0	0.0	1364
Dumbarton	N3	76.3	23.7	0.0	0.0	0.0	1249
Dumbarton	NPP1	34.1	65.9	0.0	0.0	0.0	495
Eden Landing	E1	27.4	72.6	0.0	0.0	0.0	2736
Eden Landing	E10	3.9	96.1	0.0	0.0	0.0	6973
Eden Landing	E11	5.6	94.4	0.0	0.0	0.0	948
Eden Landing	E12	65.3	34.7	0.0	0.0	0.0	406
Eden Landing	E13	61.1	38.9	0.0	0.0	0.0	211
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	124
Eden Landing	E2	12.1	87.9	0.0	0.0	0.0	12270
Eden Landing	E2C	75.0	25.0	0.0	0.0	0.0	4
Eden Landing	CP3C	13.9	86.1	0.0	0.0	0.0	223
Eden Landing	E4	92.6	7.4	0.0	0.0	0.0	54
Eden Landing	E4C	100.0	0.0	0.0	0.0	0.0	75
Eden Landing	E5	83.0	17.0	0.0	0.0	0.0	677

Complex	Pond	% Foraging	% Roosting	% Island	% Levee	% Manmade	N
Eden Landing	E5C	97.8	2.2	0.0	0.0	0.0	138
Eden Landing	E6	50.6	49.4	0.0	0.0	0.0	265
Eden Landing	E6A	14.4	85.6	0.0	0.0	0.0	6665
Eden Landing	E6B	61.0	39.0	0.0	0.0	0.0	231
Eden Landing	E6C	83.0	17.0	0.0	0.0	0.0	88
Eden Landing	E7	50.8	49.2	0.0	0.0	0.0	181
Eden Landing	E8	4.1	95.6	0.0	0.0	0.2	436
Eden Landing	E8AE	0.0	100.0	0.0	0.0	0.0	5
Eden Landing	E8AW	0.0	100.0	0.0	0.0	0.0	8
Eden Landing	E8XN	26.4	73.6	0.0	0.0	0.0	333
Eden Landing	E8XS	100.0	0.0	0.0	0.0	0.0	5
Eden Landing	E9	30.0	70.0	0.0	0.0	0.0	140
Mowry	M1	6.1	93.9	0.0	0.0	0.0	734
Mowry	M2	6.0	93.4	0.6	0.0	0.0	166
Mowry	M3	31.6	68.4	0.0	0.0	0.0	2667
Mowry	M4	70.1	29.9	0.0	0.0	0.0	796
Mowry	M5	100.0	0.0	0.0	0.0	0.0	6
Ravenswood	R1	43.3	56.7	0.0	0.0	0.0	908
Ravenswood	R2	64.2	35.8	0.0	0.0	0.0	218
Ravenswood	R3	17.9	82.1	0.0	0.0	0.0	28
Ravenswood	R4	31.4	68.6	0.0	0.0	0.0	188
Ravenswood	R5	0.0	100.0	0.0	0.0	0.0	1
Ravenswood	R5S	0.0	100.0	0.0	0.0	0.0	5
Ravenswood	RSF2U1	36.8	63.0	0.2	0.0	0.0	500
Ravenswood	RSF2U2	39.1	57.5	3.4	0.0	0.0	261
Ravenswood	RSF2U3	92.6	7.4	0.0	0.0	0.0	122
Ravenswood	RSF2U4	44.4	55.6	0.0	0.0	0.0	495

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 2021 - May 2022. 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	71.4	28.6	0	0	0.0	21
Alviso	A10	70.0	30.0	0	0	0.0	10
Alviso	A11	77.4	22.6	0	0	0.0	31
Alviso	A12	21.4	78.6	0	0	0.0	56
Alviso	A13	42.8	57.2	0	0	0.0	1424
Alviso	A14	95.4	4.6	0	0	0.0	152
Alviso	A15	0.0	100.0	0	0	0.0	13
Alviso	A16	85.0	15.0	0	0	0.0	40
Alviso	A2E	98.0	2.0	0	0	0.0	49
Alviso	A2W	73.3	23.3	0	0	3.3	30
Alviso	A3N	100.0	0.0	0	0	0.0	1
Alviso	A3W	57.3	42.7	0	0	0.0	150
Alviso	A5	63.2	36.8	0	0	0.0	163
Alviso	A6S	100.0	0.0	0	0	0.0	1
Alviso	A7	90.5	9.5	0	0	0.0	42
Alviso	A8	17.0	83.0	0	0	0.0	47
Alviso	A8S	89.5	10.5	0	0	0.0	19
Alviso	A8W	58.3	41.7	0	0	0.0	12
Alviso	A9	100.0	0.0	0	0	0.0	4
Alviso	AB1	50.0	50.0	0	0	0.0	8
Alviso	AB2	100.0	0.0	0	0	0.0	26
Coyote Hills	N1A	94.1	5.9	0	0	0.0	101
Coyote Hills	N2A	80.4	19.6	0	0	0.0	158
Coyote Hills	N3A	92.3	7.7	0	0	0.0	52
Coyote Hills	N4	81.7	18.3	0	0	0.0	71

Complex	Pond	% Foraging	% Roosting	% Island	% Levee	% Manmade	N
Coyote Hills	N4AA	100.0	0.0	0	0	0.0	209
Coyote Hills	N4AB	95.0	5.0	0	0	0.0	121
Coyote Hills	N4B	100.0	0.0	0	0	0.0	1
Coyote Hills	N5	80.0	20.0	0	0	0.0	25
Coyote Hills	N6	100.0	0.0	0	0	0.0	6
Coyote Hills	N7	50.0	50.0	0	0	0.0	24
Coyote Hills	N8	33.3	66.7	0	0	0.0	3
Coyote Hills	N9	50.0	50.0	0	0	0.0	4
Dumbarton	N1	65.7	34.3	0	0	0.0	1363
Dumbarton	N2	49.3	50.7	0	0	0.0	229
Dumbarton	N3	74.9	25.1	0	0	0.0	916
Dumbarton	NPP1	86.4	13.6	0	0	0.0	560
Eden Landing	E1	100.0	0.0	0	0	0.0	13
Eden Landing	E10	100.0	0.0	0	0	0.0	24
Eden Landing	E11	100.0	0.0	0	0	0.0	5
Eden Landing	E2	83.9	16.1	0	0	0.0	31
Eden Landing	E5	46.2	53.8	0	0	0.0	26
Eden Landing	E6	100.0	0.0	0	0	0.0	11
Eden Landing	E6A	40.0	60.0	0	0	0.0	5
Eden Landing	E6C	20.0	80.0	0	0	0.0	5
Eden Landing	E7	100.0	0.0	0	0	0.0	2
Eden Landing	E8XN	100.0	0.0	0	0	0.0	2
Mowry	M1	7.3	92.7	0	0	0.0	165
Mowry	M2	52.2	47.8	0	0	0.0	933
Mowry	M3	27.9	72.1	0	0	0.0	15442
Mowry	M4	35.3	64.7	0	0	0.0	11708
Mowry	M5	3.9	96.1	0	0	0.0	380
Mowry	M6	0.0	100.0	0	0	0.0	21

Complex	Pond	% Foraging	% Roosting	% Island	% Levee	% Manmade	N
Ravenswood	R1	33.3	66.7	0	0	0.0	27
Ravenswood	R4	100.0	0.0	0	0	0.0	1
Ravenswood	RSF2U2	100.0	0.0	0	0	0.0	2
Ravenswood	RSF2U3	50.0	50.0	0	0	0.0	8
Ravenswood	RSF2U4	33.3	66.7	0	0	0.0	3

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 2021 - May

2022. 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	56.5	21.1	0.0	0.0	22.5	356
Alviso	A10	27.3	50.8	0.0	22.0	0.0	396
Alviso	A11	20.6	25.6	0.0	53.8	0.0	1133
Alviso	A13	5.0	95.0	0.0	0.0	0.0	20
Alviso	A14	30.7	15.4	0.0	53.8	0.1	1683
Alviso	A16	36.4	10.1	44.7	0.3	8.5	967
Alviso	A17	28.8	71.2	0.0	0.0	0.0	104
Alviso	A19	0.0	100.0	0.0	0.0	0.0	8
Alviso	A2E	53.8	37.9	0.0	2.8	5.5	290
Alviso	A2W	28.5	6.8	0.0	0.0	64.6	1612
Alviso	A3N	66.7	0.0	0.0	0.0	33.3	3
Alviso	A3W	28.4	14.7	0.0	0.2	56.7	1081
Alviso	A5	15.7	3.6	0.0	80.4	0.3	1982
Alviso	A6S	60.0	20.0	0.0	0.0	20.0	5
Alviso	A7	9.3	2.8	0.2	87.3	0.5	1996
Alviso	A8	24.7	14.2	0.4	57.4	3.1	893
Alviso	A8S	25.8	35.5	0.0	37.9	0.8	256
Alviso	A8W	11.1	4.8	0.0	84.1	0.0	126
Alviso	A9	4.6	69.9	0.0	25.5	0.0	349
Alviso	AB1	16.9	9.2	4.6	10.8	58.5	65
Alviso	AB2	8.5	12.3	62.3	13.8	3.1	130
Coyote Hills	N1A	15.9	14.6	0.0	67.0	2.5	609
Coyote Hills	N2A	24.1	8.7	0.0	66.8	0.4	506
Coyote Hills	N3A	13.3	4.2	0.0	80.6	1.9	1298
Coyote Hills	N4	48.3	35.0	0.0	0.0	16.7	120
Coyote Hills	N4AA	33.8	16.2	0.0	48.0	2.0	352

Complex	Pond	% Foraging	% Roosting	% Island	% Levee	% Manmade	N
Coyote Hills	N4AB	9.9	5.2	0.1	78.6	6.2	1138
Coyote Hills	N4B	57.1	0.0	0.0	0.0	42.9	7
Coyote Hills	N5	12.9	17.7	0.0	65.9	3.4	232
Coyote Hills	N6	18.4	18.4	0.0	57.1	6.1	49
Coyote Hills	N7	58.1	7.5	0.0	29.6	4.8	186
Coyote Hills	N8	32.6	12.7	0.0	35.6	19.1	236
Coyote Hills	N9	9.8	3.3	0.0	84.7	2.2	367
Dumbarton	N1	50.0	0.0	0.0	0.0	50.0	10
Dumbarton	N2	100.0	0.0	0.0	0.0	0.0	1
Dumbarton	N3	21.0	1.2	0.0	0.0	77.8	81
Dumbarton	NPP1	80.0	20.0	0.0	0.0	0.0	5
Eden Landing	E1	29.5	5.8	15.5	30.9	18.4	207
Eden Landing	E10	69.8	2.3	11.6	0.0	16.3	43
Eden Landing	E12	10.7	6.7	1.3	81.3	0.0	75
Eden Landing	E13	14.3	0.0	14.3	64.3	7.1	14
Eden Landing	E2	50.2	3.1	0.9	36.7	9.2	327
Eden Landing	E4	3.0	2.0	0.0	95.0	0.0	101
Eden Landing	E6A	28.1	28.1	0.0	0.0	43.8	32
Eden Landing	E6B	40.0	40.0	0.0	0.0	20.0	5
Eden Landing	E7	16.4	2.8	0.0	23.4	57.3	354
Eden Landing	E8XN	100.0	0.0	0.0	0.0	0.0	6
Eden Landing	E9	22.2	55.6	0.0	0.0	22.2	9
Mowry	M1	8.5	7.0	0.0	83.7	0.8	258
Mowry	M2	2.4	14.1	71.9	11.7	0.0	505
Mowry	M3	4.6	0.0	1.4	0.0	94.0	1436
Mowry	M6	2.9	0.0	0.0	3.8	93.3	104
Ravenswood	R1	50.0	50.0	0.0	0.0	0.0	2
Ravenswood	RSF2U1	8.8	0.0	26.4	23.1	41.8	91

Complex	Pond	% Foraging	% Roosting	% Island	% Levee	% Manmade	N
Ravenswood	RSF2U2	10.6	27.7	46.8	7.4	7.4	94
Ravenswood	RSF2U4	18.5	81.5	0.0	0.0	0.0	27

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 2021 - May 2022. 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	12.3	84.1	0.0	0.1	3.6	1237
Alviso	A10	7.0	21.7	0.0	71.3	0.0	129
Alviso	A11	1.4	41.7	0.0	56.9	0.0	295
Alviso	A12	1.6	42.9	44.2	11.3	0.0	2415
Alviso	A13	49.1	29.0	7.8	14.2	0.0	1080
Alviso	A14	17.3	6.2	0.0	76.5	0.0	715
Alviso	A15	0.9	99.1	0.0	0.0	0.0	5604
Alviso	A16	11.1	37.3	51.3	0.0	0.3	1660
Alviso	A17	50.8	49.0	0.0	0.1	0.1	931
Alviso	A19	7.0	90.2	2.8	0.0	0.0	1596
Alviso	A22	6.9	93.1	0.0	0.0	0.0	727
Alviso	A23	0.0	100.0	0.0	0.0	0.0	4401
Alviso	A2E	3.5	7.0	0.4	81.2	8.0	489
Alviso	A2W	6.1	37.1	0.0	0.0	56.8	132
Alviso	A3N	1.1	62.5	0.0	0.0	36.4	261
Alviso	A3W	5.8	20.6	0.0	29.7	43.9	519
Alviso	A5	3.6	3.6	0.0	92.8	0.0	5381
Alviso	A6S	0.0	30.0	0.0	10.0	60.0	10
Alviso	A7	3.2	6.2	4.5	86.1	0.0	9937
Alviso	A8	2.4	4.5	0.0	93.0	0.2	1093
Alviso	A8S	0.5	3.6	0.0	95.9	0.0	221
Alviso	A8W	0.8	1.7	0.0	97.5	0.0	118
Alviso	A9	6.3	93.4	0.1	0.3	0.0	1494
Alviso	AB1	24.4	31.1	6.7	0.0	37.8	45
Alviso	AB2	0.8	8.4	35.0	51.2	4.7	1779
Coyote Hills	N1A	3.3	34.7	0.0	60.3	1.8	395

Complex	Pond	% Foraging	% Roosting	% Island	% Levee	% Manmade	N
Coyote Hills	N2A	3.3	6.1	0.0	90.5	0.1	1968
Coyote Hills	N3A	0.9	12.1	0.0	87.0	0.0	4456
Coyote Hills	N4	87.0	5.4	0.0	7.6	0.0	607
Coyote Hills	N4AA	6.9	71.9	0.0	10.8	10.3	203
Coyote Hills	N4AB	1.2	1.1	0.0	97.7	0.1	3329
Coyote Hills	N4B	39.5	31.6	0.0	0.0	28.9	38
Coyote Hills	N5	1.8	7.3	0.0	89.1	1.8	55
Coyote Hills	N6	0.6	0.4	0.0	99.1	0.0	1372
Coyote Hills	N7	0.8	18.5	0.0	80.6	0.0	1183
Coyote Hills	N8	0.5	26.3	0.0	73.1	0.1	1363
Coyote Hills	N9	12.5	11.5	0.2	75.7	0.0	503
Dumbarton	N1	84.0	3.5	8.7	0.3	3.5	657
Dumbarton	N2	56.2	24.7	17.8	1.4	0.0	219
Dumbarton	N3	88.4	0.8	3.8	4.5	2.4	2043
Dumbarton	NPP1	24.7	67.1	4.1	0.3	3.8	340
Eden Landing	E1	58.9	30.5	3.5	5.0	2.1	141
Eden Landing	E10	0.0	28.6	57.1	0.0	14.3	7
Eden Landing	E11	0.5	99.1	0.0	0.0	0.5	216
Eden Landing	E12	1.7	26.8	41.3	28.2	2.0	298
Eden Landing	E13	5.1	12.8	5.1	76.9	0.0	39
Eden Landing	E2	63.4	17.2	16.1	0.0	3.2	93
Eden Landing	CP3C	0.5	99.3	0.0	0.0	0.1	755
Eden Landing	E4	1.1	93.9	0.0	0.6	4.4	181
Eden Landing	E4C	0.0	100.0	0.0	0.0	0.0	44
Eden Landing	E5	19.1	61.7	0.0	4.3	14.9	47
Eden Landing	E5C	95.8	4.2	0.0	0.0	0.0	95
Eden Landing	E6	31.2	63.9	0.0	0.0	4.9	612
Eden Landing	E6A	2.5	95.7	0.0	0.0	1.7	629

Complex	Pond	% Foraging	% Roosting	% Island	% Levee	% Manmade	N
Eden Landing	E6B	100.0	0.0	0.0	0.0	0.0	2
Eden Landing	E6C	92.0	0.0	0.0	0.0	8.0	113
Eden Landing	E7	0.0	33.3	0.0	28.2	38.5	39
Eden Landing	E9	0.0	28.6	14.3	0.0	57.1	7
Mowry	M1	1.1	13.8	0.0	85.1	0.0	544
Mowry	M2	0.3	5.4	87.9	6.4	0.0	3917
Mowry	M3	21.5	9.4	64.1	4.8	0.1	8981
Mowry	M4	83.3	0.6	0.0	16.0	0.0	4339
Mowry	M5	25.7	47.0	0.0	27.3	0.0	1320
Mowry	M6	0.0	36.1	0.0	45.8	18.1	557
Ravenswood	R1	0.5	96.9	0.0	0.0	2.6	193
Ravenswood	R2	90.0	9.6	0.0	0.0	0.4	460
Ravenswood	R4	60.0	40.0	0.0	0.0	0.0	15
Ravenswood	RSF2U1	5.5	5.0	35.4	12.7	41.4	181
Ravenswood	RSF2U2	0.0	9.6	84.3	6.2	0.0	178
Ravenswood	RSF2U3	40.0	60.0	0.0	0.0	0.0	60
Ravenswood	RSF2U4	0.0	50.0	0.0	50.0	0.0	2

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 2021 -

May 2022. 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	31.7	2.4	2.4	53.7	9.8	82
Alviso	A10	71.2	0.0	0.0	28.8	0.0	66
Alviso	A11	68.2	0.0	0.0	31.8	0.0	151
Alviso	A13	0.0	0.0	0.0	100.0	0.0	1
Alviso	A14	74.6	0.0	0.0	21.6	3.7	134
Alviso	A15	0.0	100.0	0.0	0.0	0.0	1
Alviso	A16	78.9	6.9	9.7	3.4	1.1	175
Alviso	A17	60.7	21.4	0.0	10.7	7.1	28
Alviso	A19	35.7	57.1	0.0	0.0	7.1	14
Alviso	A22	80.0	0.0	0.0	0.0	20.0	5
Alviso	A23	50.0	0.0	0.0	0.0	50.0	2
Alviso	A2E	66.7	2.5	1.2	21.0	8.6	81
Alviso	A2W	59.3	16.1	0.0	11.9	12.7	118
Alviso	A3N	66.7	0.0	0.0	0.0	33.3	15
Alviso	A3W	77.7	3.3	0.0	10.7	8.3	121
Alviso	A5	66.7	10.7	0.0	18.7	4.0	75
Alviso	A6S	40.7	37.0	0.0	3.7	18.5	27
Alviso	A7	82.5	4.8	0.0	12.7	0.0	63
Alviso	A8	53.4	19.0	0.0	24.1	3.4	58
Alviso	A8S	38.2	1.5	0.0	58.8	1.5	68
Alviso	A8W	33.3	8.3	0.0	58.3	0.0	12
Alviso	A9	90.2	4.9	0.0	4.9	0.0	61
Alviso	AB1	69.4	4.2	4.2	15.3	6.9	72
Alviso	AB2	67.0	8.7	2.6	14.8	7.0	115
Coyote Hills	N1A	69.8	3.1	0.0	21.9	5.2	96
Coyote Hills	N2A	46.9	0.0	0.0	53.1	0.0	32

Complex	Pond	% Foraging	% Roosting	% Island	% Levee	% Manmade	N
Coyote Hills	N3A	82.9	2.4	0.0	12.2	2.4	41
Coyote Hills	N4	85.0	10.0	5.0	0.0	0.0	20
Coyote Hills	N4AA	72.1	4.7	0.0	17.4	5.8	86
Coyote Hills	N4AB	36.4	29.1	3.6	30.9	0.0	55
Coyote Hills	N4B	73.8	11.5	0.0	4.9	9.8	61
Coyote Hills	N5	66.7	0.0	0.0	33.3	0.0	12
Coyote Hills	N6	78.3	13.0	0.0	8.7	0.0	23
Coyote Hills	N7	85.7	0.0	0.0	11.9	2.4	42
Coyote Hills	N8	44.0	21.4	0.0	33.3	1.2	84
Coyote Hills	N9	35.3	23.5	0.0	41.2	0.0	34
Dumbarton	N1	50.0	0.0	50.0	0.0	0.0	2
Dumbarton	N3	40.0	5.0	0.0	35.0	20.0	20
Eden Landing	E1	65.3	8.2	2.0	18.4	6.1	49
Eden Landing	E10	78.4	0.0	8.1	10.8	2.7	37
Eden Landing	E11	50.0	12.5	0.0	25.0	12.5	8
Eden Landing	E12	71.4	8.6	0.0	14.3	5.7	35
Eden Landing	E13	63.3	16.7	0.0	20.0	0.0	30
Eden Landing	E14	100.0	0.0	0.0	0.0	0.0	3
Eden Landing	E1C	100.0	0.0	0.0	0.0	0.0	2
Eden Landing	E2	75.2	1.4	2.1	9.0	12.4	145
Eden Landing	E2C	100.0	0.0	0.0	0.0	0.0	6
Eden Landing	CP3C	83.3	16.7	0.0	0.0	0.0	12
Eden Landing	E4	52.0	0.0	0.0	12.0	36.0	25
Eden Landing	E5	0.0	100.0	0.0	0.0	0.0	1
Eden Landing	E6	50.0	25.0	0.0	25.0	0.0	4
Eden Landing	E6A	95.0	2.5	0.0	0.0	2.5	80
Eden Landing	E6B	69.6	30.4	0.0	0.0	0.0	23
Eden Landing	E7	55.8	3.5	3.5	4.7	32.6	86

Complex	Pond	% Foraging	% Roosting	% Island	% Levee	% Manmade	N
Eden Landing	E8	91.7	0.0	0.0	0.0	8.3	12
Eden Landing	E8AE	64.3	35.7	0.0	0.0	0.0	14
Eden Landing	E8AW	50.0	50.0	0.0	0.0	0.0	16
Eden Landing	E8XN	80.0	20.0	0.0	0.0	0.0	5
Eden Landing	E8XS	50.0	50.0	0.0	0.0	0.0	4
Eden Landing	E9	18.5	9.2	0.0	69.2	3.1	65
Mowry	M1	71.4	0.0	0.0	28.6	0.0	21
Mowry	M2	30.0	0.0	0.0	70.0	0.0	10
Mowry	M3	100.0	0.0	0.0	0.0	0.0	1
Mowry	M4	0.0	0.0	0.0	100.0	0.0	1
Mowry	M6	0.0	0.0	0.0	100.0	0.0	1
Ravenswood	R1	87.5	12.5	0.0	0.0	0.0	8
Ravenswood	R2	100.0	0.0	0.0	0.0	0.0	1
Ravenswood	R4	0.0	33.3	0.0	66.7	0.0	3
Ravenswood	RSF2U1	38.2	19.6	22.5	3.9	15.7	102
Ravenswood	RSF2U2	72.7	0.0	22.7	4.5	0.0	44
Ravenswood	RSF2U3	0.0	0.0	0.0	100.0	0.0	1
Ravenswood	RSF2U4	81.8	0.0	0.0	18.2	0.0	11

Table 11. 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 2021 -

May 2022. 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	83.3	11.1	0.0	0.0	5.6	18
Alviso	A10	90.5	0.5	0.0	9.0	0.0	199
Alviso	A11	44.4	25.0	0.0	30.6	0.0	36
Alviso	A12	50.0	50.0	0.0	0.0	0.0	4
Alviso	A13	56.0	42.5	1.2	0.3	0.0	339
Alviso	A14	40.1	0.3	0.0	59.6	0.0	399
Alviso	A15	60.0	40.0	0.0	0.0	0.0	10
Alviso	A16	7.6	77.3	15.0	0.1	0.0	1251
Alviso	A17	74.9	25.1	0.0	0.0	0.0	2268
Alviso	A19	94.2	5.8	0.0	0.0	0.0	2685
Alviso	A22	35.0	65.0	0.0	0.0	0.0	1424
Alviso	A23	7.6	92.4	0.0	0.0	0.0	2659
Alviso	A2E	75.0	12.5	0.0	0.0	12.5	16
Alviso	A2W	57.1	0.0	0.0	42.9	0.0	7
Alviso	A3N	3.4	96.6	0.0	0.0	0.0	6709
Alviso	A3W	3.2	95.9	0.0	0.9	0.0	567
Alviso	A5	19.0	0.0	0.0	81.0	0.0	42
Alviso	A6S	12.5	87.5	0.0	0.0	0.0	1789
Alviso	A7	52.9	10.0	5.7	31.4	0.0	70
Alviso	A8	21.9	45.3	0.0	32.8	0.0	64
Alviso	A8S	63.6	0.0	0.0	36.4	0.0	11
Alviso	A8W	66.7	0.0	0.0	33.3	0.0	6
Alviso	A9	27.6	72.3	0.0	0.0	0.0	14160
Alviso	AB1	20.1	79.8	0.2	0.0	0.0	8185
Alviso	AB2	28.1	70.2	1.7	0.0	0.0	5604
Coyote Hills	N1A	2.5	59.0	0.0	38.5	0.0	122

Complex	Pond	% Foraging	% Roosting	% Island	% Levee	% Manmade	N
Coyote Hills	N2A	0.0	0.0	0.0	100.0	0.0	99
Coyote Hills	N3A	29.9	63.3	0.0	6.8	0.0	264
Coyote Hills	N4	0.1	66.1	33.1	0.6	0.0	1578
Coyote Hills	N4AA	76.9	7.9	0.0	14.9	0.3	390
Coyote Hills	N4AB	20.0	0.0	0.0	80.0	0.0	5
Coyote Hills	N4B	60.0	14.4	0.0	23.7	2.0	355
Coyote Hills	N5	0.0	0.0	0.0	100.0	0.0	42
Coyote Hills	N6	88.9	11.1	0.0	0.0	0.0	9
Coyote Hills	N7	9.1	2.3	0.0	88.6	0.0	44
Coyote Hills	N8	3.3	3.9	0.0	92.8	0.0	360
Coyote Hills	N9	8.8	33.0	39.2	18.9	0.0	454
Dumbarton	N1	25.8	27.8	31.2	0.0	15.2	2934
Dumbarton	N2	14.7	84.6	0.7	0.0	0.0	1358
Dumbarton	N3	30.0	9.5	54.0	6.5	0.0	2152
Dumbarton	NPP1	45.8	40.4	12.5	0.9	0.4	1145
Eden Landing	E1	22.8	76.4	0.0	0.8	0.0	127
Eden Landing	E10	5.8	85.6	8.2	0.0	0.4	1533
Eden Landing	E11	11.9	87.5	0.0	0.0	0.7	13505
Eden Landing	E12	34.2	37.9	1.8	3.5	22.6	2900
Eden Landing	E13	48.7	36.5	4.4	2.6	7.7	2406
Eden Landing	E14	64.3	35.7	0.0	0.0	0.0	14
Eden Landing	E1C	64.7	35.3	0.0	0.0	0.0	377
Eden Landing	E2	56.7	11.9	31.3	0.1	0.0	3476
Eden Landing	E2C	36.0	64.0	0.0	0.0	0.0	1575
Eden Landing	CP3C	43.8	44.9	0.8	0.0	10.5	1975
Eden Landing	E4	80.6	16.3	0.0	1.6	1.6	129
Eden Landing	E4C	30.7	51.0	0.0	0.0	18.3	2492
Eden Landing	E5	23.8	69.2	0.0	0.0	7.0	1995

Complex	Pond	% Foraging	% Roosting	% Island	% Levee	% Manmade	N
Eden Landing	E5C	48.3	51.6	0.0	0.0	0.1	995
Eden Landing	E6	45.4	50.7	0.0	0.5	3.4	412
Eden Landing	E6A	43.0	57.0	0.0	0.0	0.0	2797
Eden Landing	E6B	24.6	75.4	0.0	0.0	0.0	2074
Eden Landing	E6C	60.8	39.2	0.0	0.0	0.0	719
Eden Landing	E7	0.8	0.4	0.0	0.0	98.9	266
Eden Landing	E8	53.8	46.2	0.0	0.0	0.0	195
Eden Landing	E8AE	1.1	98.9	0.0	0.0	0.0	2804
Eden Landing	E8AW	18.6	81.4	0.0	0.0	0.0	1176
Eden Landing	E8XN	100.0	0.0	0.0	0.0	0.0	4
Eden Landing	E8XS	16.7	83.3	0.0	0.0	0.0	24
Eden Landing	E9	16.2	83.1	0.0	0.0	0.7	5990
Mowry	M1	1.6	34.1	0.0	64.3	0.0	4403
Mowry	M2	0.0	0.0	28.9	71.1	0.0	2010
Mowry	M3	59.7	2.5	37.6	0.1	0.0	1177
Mowry	M4	93.5	0.0	0.0	6.5	0.0	199
Mowry	M5	82.3	15.3	1.5	0.9	0.0	531
Mowry	M6	100.0	0.0	0.0	0.0	0.0	1
Ravenswood	R1	3.9	96.0	0.0	0.0	0.0	8859
Ravenswood	R2	83.0	17.0	0.0	0.0	0.0	735
Ravenswood	R3	11.4	88.6	0.0	0.0	0.0	377
Ravenswood	R4	42.0	58.0	0.0	0.0	0.0	112
Ravenswood	R5	4.0	96.0	0.0	0.0	0.0	574
Ravenswood	R5S	10.2	89.8	0.0	0.0	0.0	49
Ravenswood	RSF2U1	2.3	16.7	74.3	6.6	0.1	11018
Ravenswood	RSF2U2	3.4	15.3	48.4	32.9	0.0	4038
Ravenswood	RSF2U3	76.0	24.0	0.0	0.0	0.0	50
Ravenswood	RSF2U4	43.9	54.5	0.0	1.6	0.0	189

Table 12. 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 2021 - May 2022. 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	A13	100.0	0.0	0	0	0	78
Coyote Hills	N4	100.0	0.0	0	0	0	42
Coyote Hills	N4B	100.0	0.0	0	0	0	4
Coyote Hills	N8	100.0	0.0	0	0	0	6
Dumbarton	N2	91.8	8.2	0	0	0	134
Dumbarton	N3	100.0	0.0	0	0	0	17
Dumbarton	NPP1	100.0	0.0	0	0	0	211
Eden Landing	E10	100.0	0.0	0	0	0	153
Eden Landing	E11	100.0	0.0	0	0	0	29
Eden Landing	E13	100.0	0.0	0	0	0	2
Eden Landing	E2	100.0	0.0	0	0	0	250
Eden Landing	CP3C	100.0	0.0	0	0	0	1
Eden Landing	E4	100.0	0.0	0	0	0	1
Eden Landing	E5	100.0	0.0	0	0	0	1
Mowry	M1	100.0	0.0	0	0	0	4
Mowry	M3	100.0	0.0	0	0	0	2
Ravenswood	R1	100.0	0.0	0	0	0	5

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 2021 - May 2022. 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

Complex	Pond	% Foraging	% Roosting	% Island	% Levee	% Manmade	N
Alviso	A1	0.0	0.0	0.0	100.0	0.0	17
Alviso	A10	38.5	12.0	0.0	49.5	0.0	831
Alviso	A11	48.3	9.8	0.0	41.9	0.0	549
Alviso	A12	29.5	68.1	1.3	1.1	0.0	1797
Alviso	A13	27.6	71.1	0.0	1.3	0.0	4141
Alviso	A14	5.3	2.6	0.0	92.1	0.0	265
Alviso	A15	2.0	98.0	0.0	0.0	0.0	19827
Alviso	A16	11.2	88.1	0.7	0.0	0.0	4849
Alviso	A17	90.8	9.2	0.0	0.0	0.0	937
Alviso	A19	96.3	3.7	0.0	0.0	0.0	912
Alviso	A22	34.2	65.8	0.0	0.1	0.0	5546
Alviso	A23	45.7	54.3	0.0	0.0	0.0	3303
Alviso	A2E	64.9	29.1	2.0	0.7	3.3	302
Alviso	A2W	25.9	14.8	0.0	40.7	18.5	27
Alviso	A3N	7.6	92.3	0.0	0.0	0.0	93000
Alviso	A3W	91.2	8.8	0.0	0.0	0.0	795
Alviso	A5	5.0	0.0	0.0	95.0	0.0	261
Alviso	A6S	91.5	7.4	0.0	0.0	1.1	16516
Alviso	A7	9.1	5.0	0.0	85.8	0.0	1292
Alviso	A8	91.0	0.0	0.0	9.0	0.0	212
Alviso	A8S	30.7	0.0	0.0	69.3	0.0	88
Alviso	A8W	20.5	0.0	0.0	79.5	0.0	73
Alviso	A9	35.2	64.1	0.0	0.7	0.0	35376
Alviso	AB1	59.7	38.0	2.3	0.0	0.0	3346
Alviso	AB2	62.2	33.7	4.1	0.0	0.0	7156
Coyote Hills	N1A	12.5	0.0	0.0	87.5	0.0	8
Coyote Hills	N2A	100.0	0.0	0.0	0.0	0.0	2
Coyote Hills	N3A	84.8	15.1	0.0	0.1	0.0	896

Complex	Pond	% Foraging	% Roosting	% Island	% Levee	% Manmade	N
Coyote Hills	N4	70.0	17.6	0.9	10.0	1.5	743
Coyote Hills	N4AA	93.5	6.5	0.0	0.0	0.0	557
Coyote Hills	N4AB	0.0	100.0	0.0	0.0	0.0	10
Coyote Hills	N4B	77.6	3.8	0.0	11.0	7.6	798
Coyote Hills	N5	23.3	41.2	0.0	35.4	0.0	257
Coyote Hills	N6	76.4	23.6	0.0	0.0	0.0	368
Coyote Hills	N7	52.1	0.0	0.0	47.9	0.0	167
Coyote Hills	N8	39.2	12.5	0.0	48.3	0.0	176
Coyote Hills	N9	74.2	20.9	0.0	4.9	0.0	1405
Dumbarton	N1	17.7	17.6	50.5	0.0	14.2	3260
Dumbarton	N2	12.4	87.2	0.0	0.4	0.0	1291
Dumbarton	N3	11.1	3.4	64.1	21.1	0.3	1548
Dumbarton	NPP1	35.2	41.7	19.7	2.2	1.1	8153
Eden Landing	E1	100.0	0.0	0.0	0.0	0.0	5
Eden Landing	E10	56.0	44.0	0.0	0.0	0.0	252
Eden Landing	E11	29.2	70.7	0.0	0.0	0.1	7751
Eden Landing	E12	22.5	39.6	33.2	3.3	1.3	13231
Eden Landing	E13	66.1	27.0	5.9	0.9	0.2	17529
Eden Landing	E14	65.6	34.4	0.0	0.0	0.0	6067
Eden Landing	E1C	95.4	4.6	0.0	0.0	0.0	1232
Eden Landing	E2	57.7	4.8	37.1	0.4	0.0	4752
Eden Landing	E2C	39.4	60.6	0.0	0.0	0.0	2634
Eden Landing	CP3C	62.2	32.3	0.0	0.0	5.4	8564
Eden Landing	E4	49.2	50.4	0.0	0.2	0.1	8605
Eden Landing	E4C	18.7	81.2	0.0	0.0	0.0	30764
Eden Landing	E5	33.0	66.5	0.0	0.1	0.4	9272
Eden Landing	E5C	12.0	88.0	0.0	0.0	0.0	9196
Eden Landing	E6	79.1	20.7	0.0	0.0	0.3	2741

Complex	Pond	% Foraging	% Roosting	% Island	% Levee	% Manmade	N
Eden Landing	E6A	83.7	16.2	0.1	0.0	0.0	25708
Eden Landing	E6B	68.5	31.5	0.0	0.0	0.0	19417
Eden Landing	E6C	62.2	37.8	0.0	0.0	0.0	5300
Eden Landing	E7	67.0	29.1	0.3	0.0	3.6	309
Eden Landing	E8	50.2	48.6	0.0	0.0	1.2	3304
Eden Landing	E8AE	6.3	93.7	0.0	0.0	0.0	18355
Eden Landing	E8AW	91.5	8.5	0.0	0.0	0.0	5433
Eden Landing	E8XN	87.7	0.0	0.0	12.3	0.0	73
Eden Landing	E8XS	91.2	8.8	0.0	0.0	0.0	1049
Eden Landing	E9	38.1	61.9	0.0	0.0	0.0	11825
Mowry	M1	15.5	23.0	0.0	61.5	0.0	10687
Mowry	M2	0.1	0.1	43.1	56.6	0.0	17140
Mowry	M3	29.9	8.3	46.7	0.6	14.4	7550
Mowry	M4	49.3	5.0	0.0	45.6	0.0	2840
Mowry	M5	73.5	6.9	3.5	13.9	2.2	3834
Mowry	M6	60.5	39.4	0.0	0.0	0.0	4564
Ravenswood	R1	25.3	73.5	0.2	1.0	0.0	51701
Ravenswood	R2	33.4	66.6	0.0	0.0	0.0	39101
Ravenswood	R3	26.2	73.8	0.0	0.0	0.0	1458
Ravenswood	R4	39.2	60.1	0.0	0.7	0.0	1850
Ravenswood	R5	95.7	4.3	0.0	0.0	0.0	47
Ravenswood	R5S	64.0	36.0	0.0	0.0	0.0	50
Ravenswood	RSF2U1	16.3	0.4	52.7	30.6	0.0	245
Ravenswood	RSF2U2	14.0	30.5	43.0	12.5	0.0	781
Ravenswood	RSF2U3	45.3	28.3	26.4	0.0	0.0	1458
Ravenswood	RSF2U4	96.6	3.4	0.0	0.0	0.0	203

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 2021 - May 2022. 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	30.8	0.0	0.0	0.0	69.2	39

Complex	Pond	% Foraging	% Roosting	% Island	% Levee	% Manmade	N
Alviso	A10	14.3	0.0	0.0	85.7	0.0	7
Alviso	A11	18.2	0.0	0.0	72.7	9.1	11
Alviso	A13	20.0	0.0	0.0	0.0	80.0	10
Alviso	A14	14.7	3.7	0.0	81.3	0.2	428
Alviso	A16	3.5	71.7	20.7	0.0	4.2	692
Alviso	A17	0.0	100.0	0.0	0.0	0.0	1
Alviso	A2E	6.2	51.0	0.0	0.0	42.7	241
Alviso	A2W	16.0	0.0	0.0	0.0	84.0	150
Alviso	A3N	10.0	90.0	0.0	0.0	0.0	30
Alviso	A3W	56.2	0.0	0.0	0.0	43.8	16
Alviso	A5	100.0	0.0	0.0	0.0	0.0	56
Alviso	A7	13.8	82.1	0.0	0.0	4.1	195
Alviso	A8	0.0	0.0	0.0	0.0	100.0	4
Alviso	A8S	66.7	33.3	0.0	0.0	0.0	3
Alviso	A8W	100.0	0.0	0.0	0.0	0.0	1
Alviso	A9	1.9	96.5	0.0	0.0	1.6	374
Alviso	AB1	10.4	1.2	0.0	0.0	88.4	164
Alviso	AB2	2.9	92.9	0.9	0.0	3.3	580
Coyote Hills	N1A	80.0	0.0	0.0	20.0	0.0	10
Coyote Hills	N2A	0.0	0.0	0.0	100.0	0.0	1
Coyote Hills	N3A	20.8	0.0	0.0	20.8	58.3	24
Coyote Hills	N4	33.3	0.0	0.0	0.0	66.7	3
Coyote Hills	N4AA	13.4	0.0	0.0	0.8	85.8	127
Coyote Hills	N4AB	60.0	0.0	0.0	0.0	40.0	5
Coyote Hills	N4B	100.0	0.0	0.0	0.0	0.0	2
Coyote Hills	N5	37.5	0.0	0.0	0.0	62.5	8
Coyote Hills	N6	100.0	0.0	0.0	0.0	0.0	2
Coyote Hills	N7	9.5	68.2	0.0	0.0	22.3	220

Complex	Pond	% Foraging	% Roosting	% Island	% Levee	% Manmade	N
Coyote Hills	N8	0.4	2.2	0.0	96.0	1.3	226
Dumbarton	N2	100.0	0.0	0.0	0.0	0.0	1
Dumbarton	N3	88.9	0.0	0.0	0.0	11.1	9
Eden Landing	E1	64.5	0.0	6.5	19.4	9.7	62
Eden Landing	E10	25.6	2.3	14.0	0.0	58.1	43
Eden Landing	E11	0.0	0.0	0.0	0.0	100.0	19
Eden Landing	E12	15.4	4.6	15.4	1.5	63.1	65
Eden Landing	E13	62.5	0.0	37.5	0.0	0.0	8
Eden Landing	E2	46.7	1.1	1.6	2.2	48.4	182
Eden Landing	E4	0.0	100.0	0.0	0.0	0.0	4
Eden Landing	E5	0.0	0.0	0.0	0.0	100.0	14
Eden Landing	E6	0.0	100.0	0.0	0.0	0.0	2
Eden Landing	E6A	25.0	33.3	0.0	0.0	41.7	12
Eden Landing	E7	0.4	6.4	0.0	0.1	93.1	1221
Eden Landing	E8	100.0	0.0	0.0	0.0	0.0	5
Eden Landing	E8XN	100.0	0.0	0.0	0.0	0.0	3
Eden Landing	E9	2.6	41.0	0.0	0.0	56.4	39
Mowry	M1	37.4	43.6	0.0	3.9	15.2	257
Mowry	M2	79.7	0.0	3.4	13.6	3.4	59
Ravenswood	R1	6.0	19.0	0.0	0.0	75.0	84
Ravenswood	RSF2U1	1.3	3.3	70.2	0.0	25.1	668
Ravenswood	RSF2U2	2.2	11.4	83.2	2.1	1.1	808
Ravenswood	RSF2U4	100.0	0.0	0.0	0.0	0.0	2

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 Science Advisory Team. 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.

Species/Guild	Season	SBSPRP Target	Threshold	Data Year	Percent Change	Trigger
Ruddy ducks	Winter	12602	-15	2022	159%	FALSE
diving ducks	Winter	39645	-20	2022	47%	FALSE
small shorebirds	Fall	60623	-20	2021	48%	FALSE
small shorebirds	Spring	73728	-20	2022	59%	FALSE
Eared grebes	Winter	5640	-50	2022	17%	FALSE
phalaropes	Summer	3225	-50	2017	-78%	TRUE
Bonaparte’s gulls	Winter	1270	-50	2022	-84%	TRUE
dabbling ducks	Winter			2022	-28%	FALSE
medium shorebirds	Winter			2022	-8%	FALSE
Least terns	Summer	63		2017	21%	FALSE

Figures

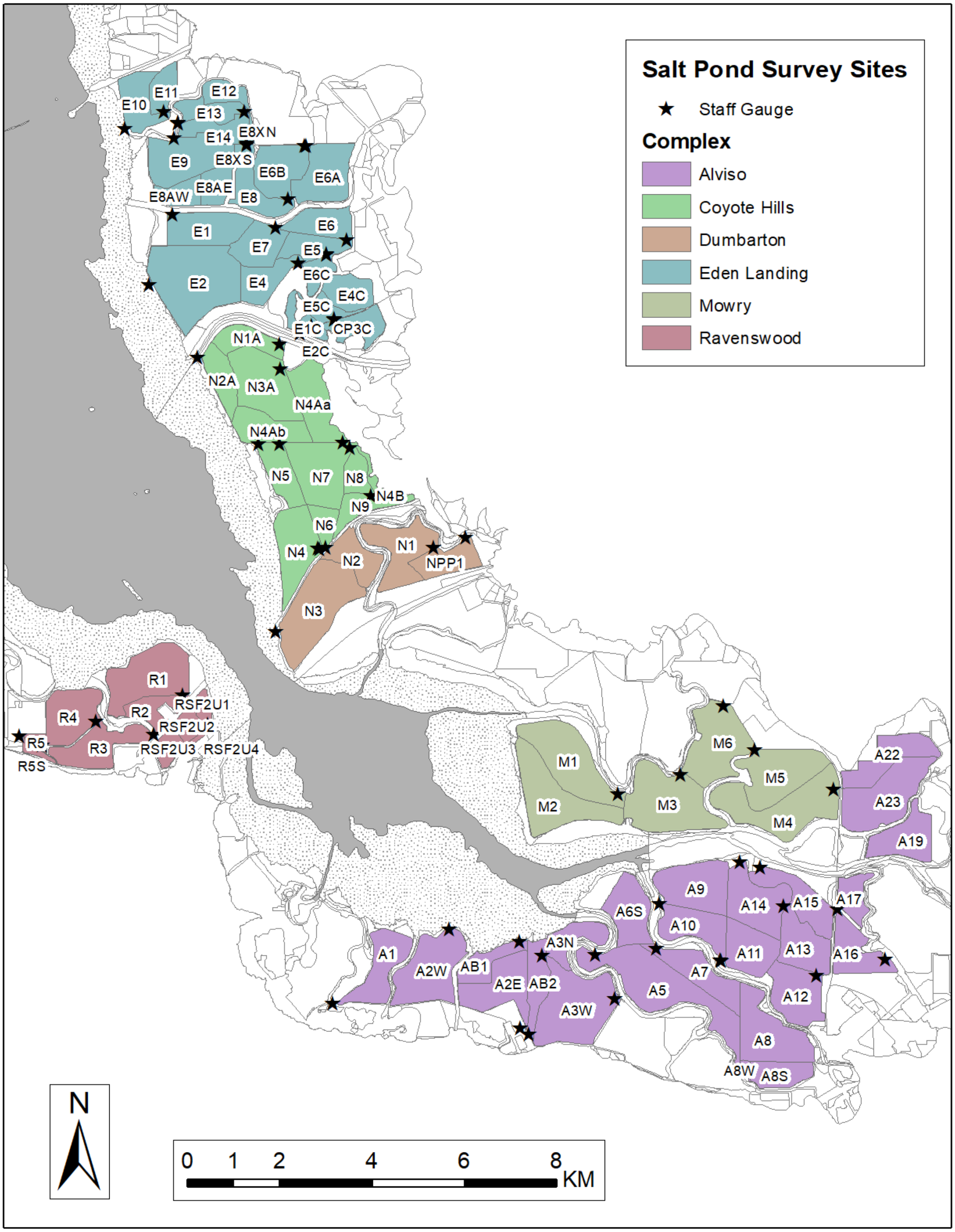

Figure 1. Map of the study area and all ponds surveyed by the San Francisco Bay Bird Observatory from September 2021–May 2022, South San Francisco Bay, California.

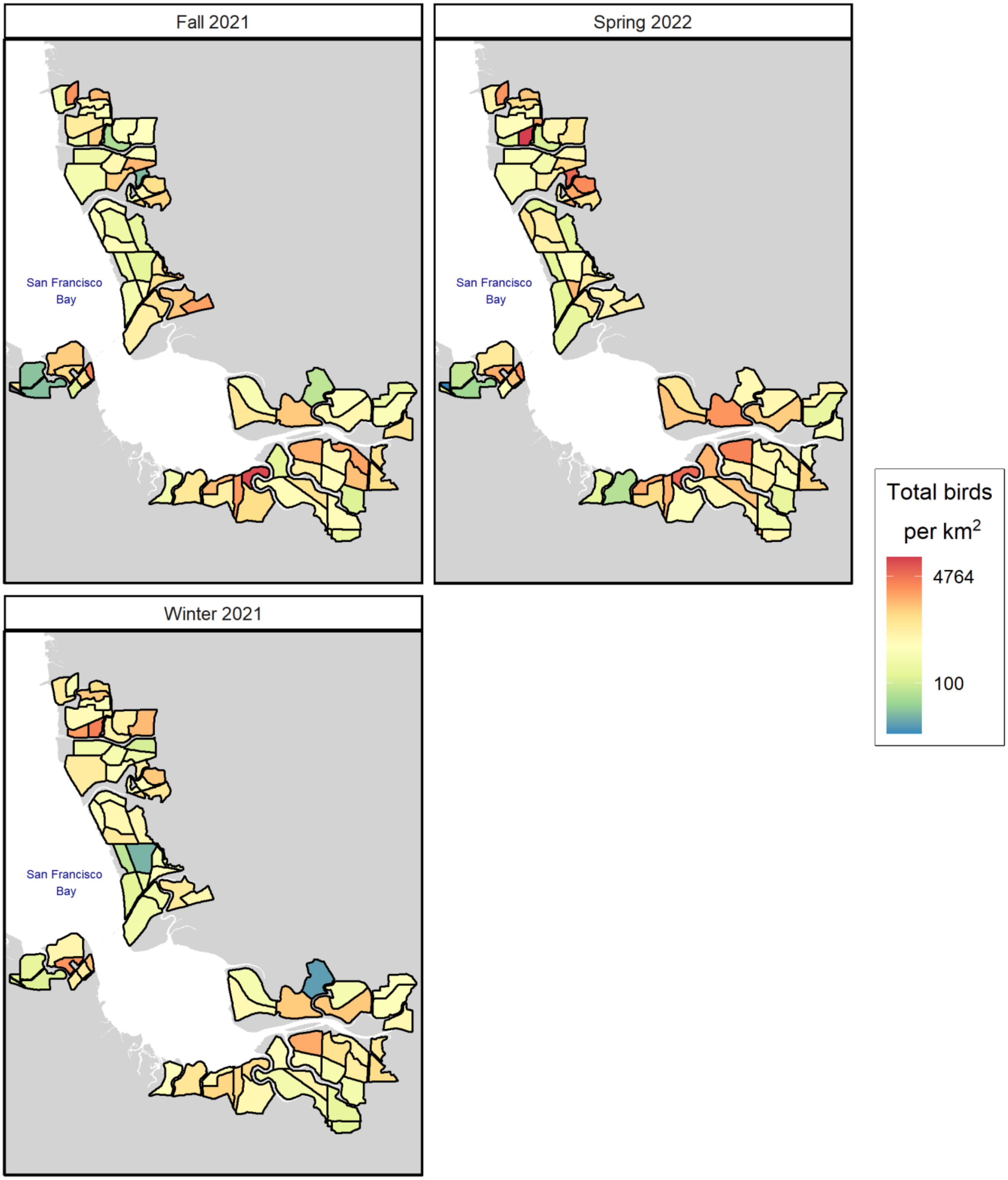

Figure 2. Density of total birds averaged across survey rounds by season, South San Francisco Bay, California; September 2021–May 2022. Dark grey ponds had no birds.

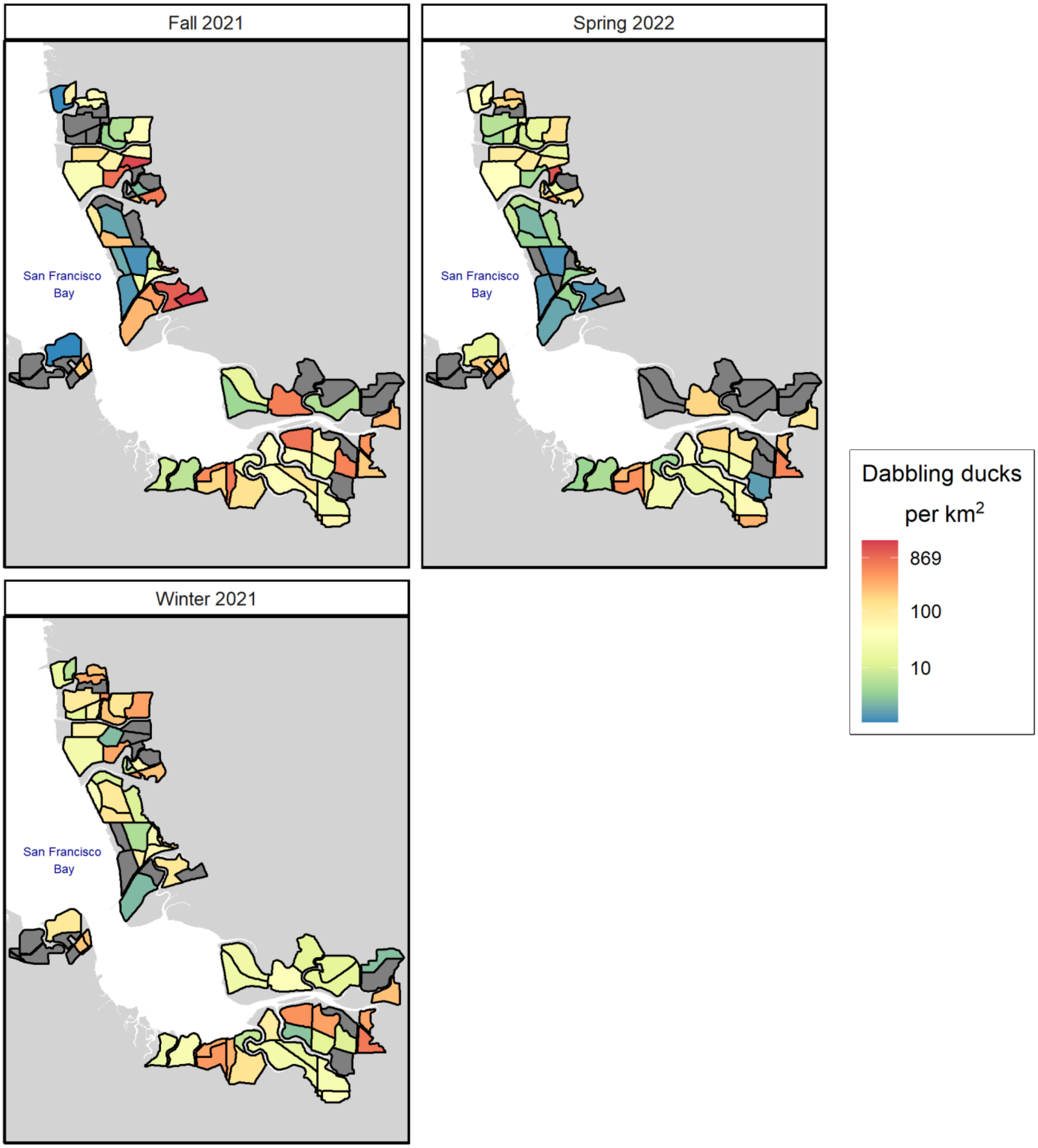

Figure 3. Density of dabbling ducks averaged across survey rounds by season, South San Francisco Bay, California; September 2021–May 2022. Dark grey ponds had no birds.

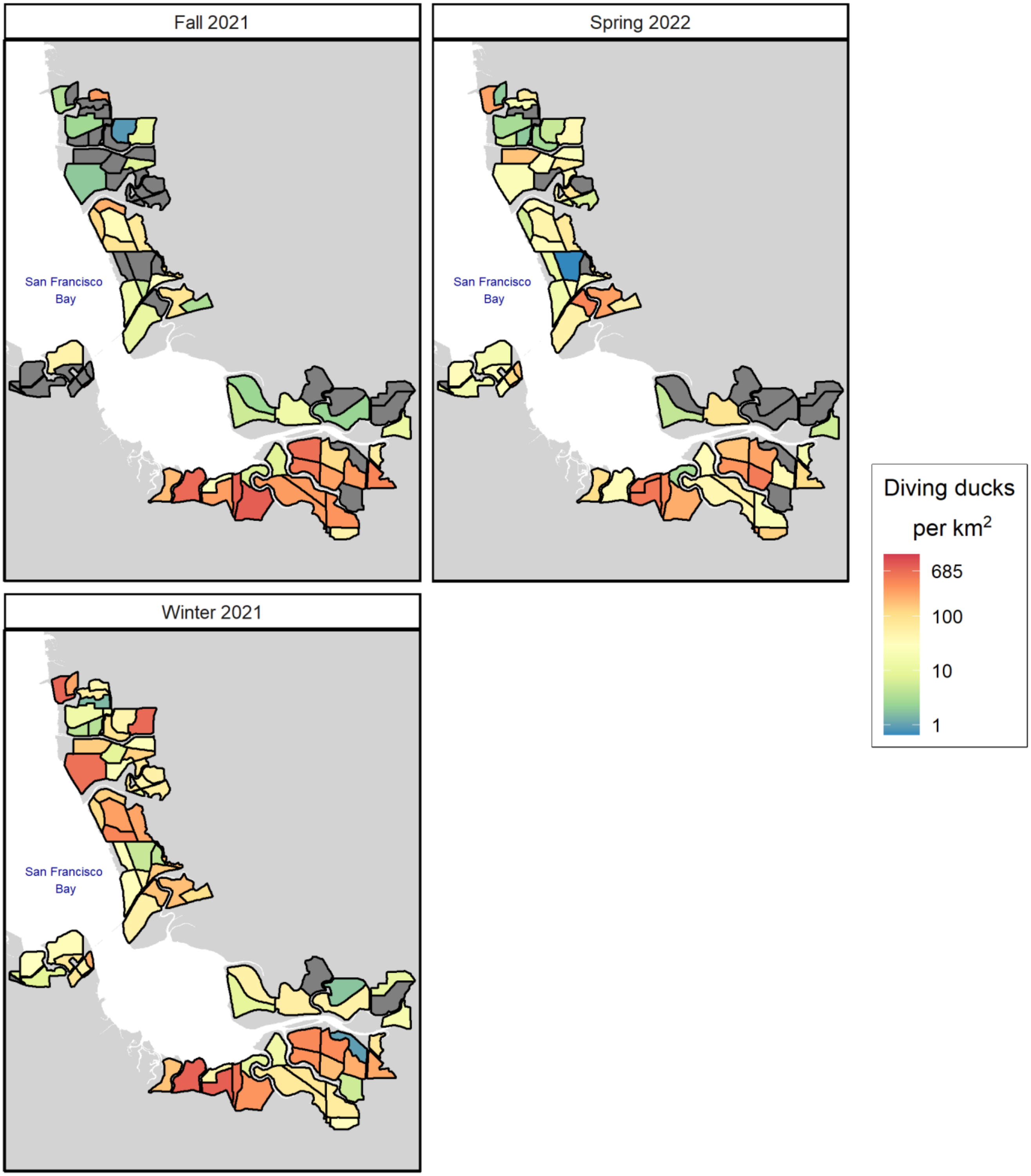

Figure 4. Density of diving ducks averaged across survey rounds by season, South San Francisco Bay, California; September 2021–May 2022. Dark grey ponds had no birds.

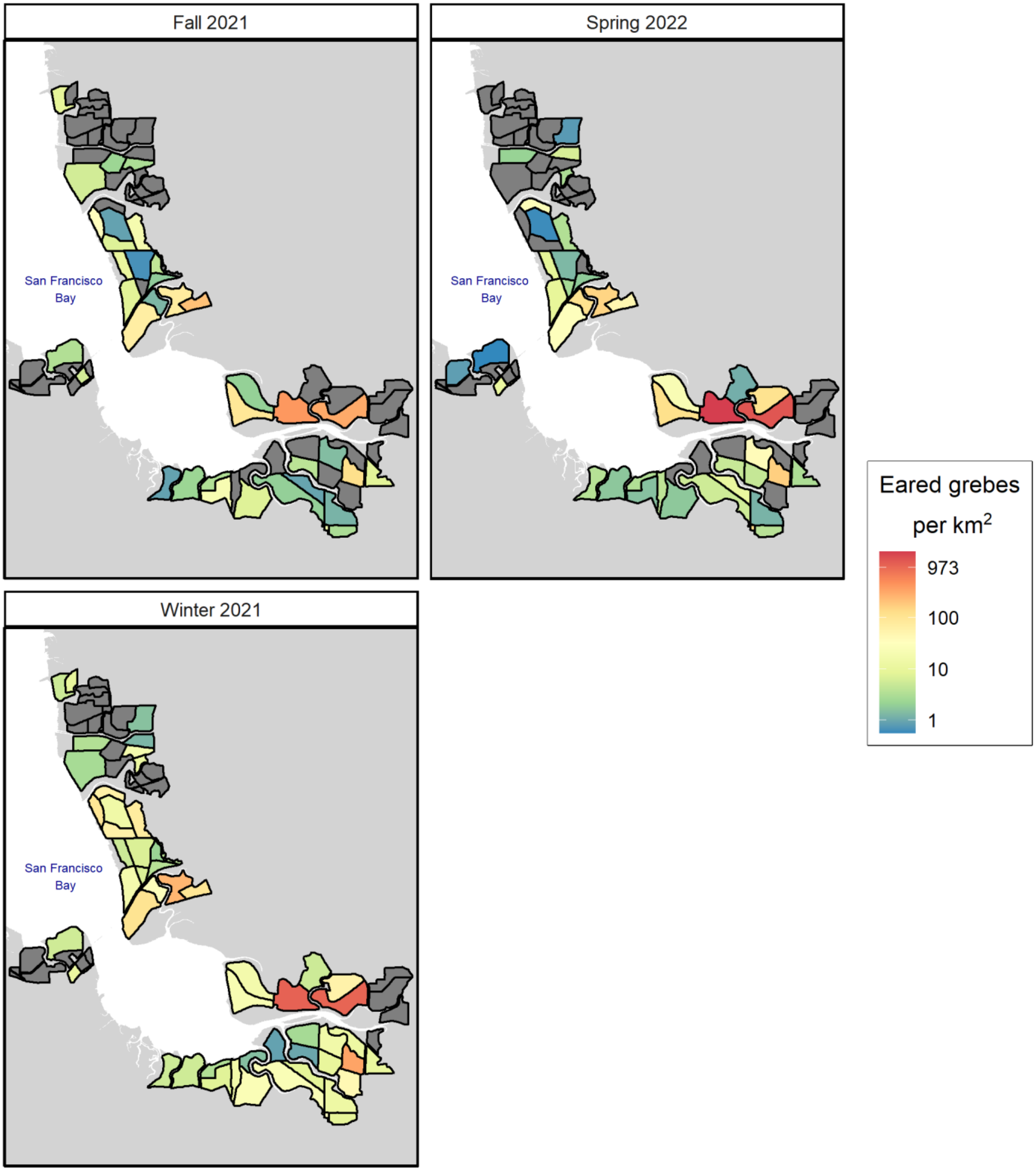

Figure 5. Density of eared grebes averaged across survey rounds by season, South San Francisco Bay, California; September 2021–May 2022. Dark grey ponds had no birds.

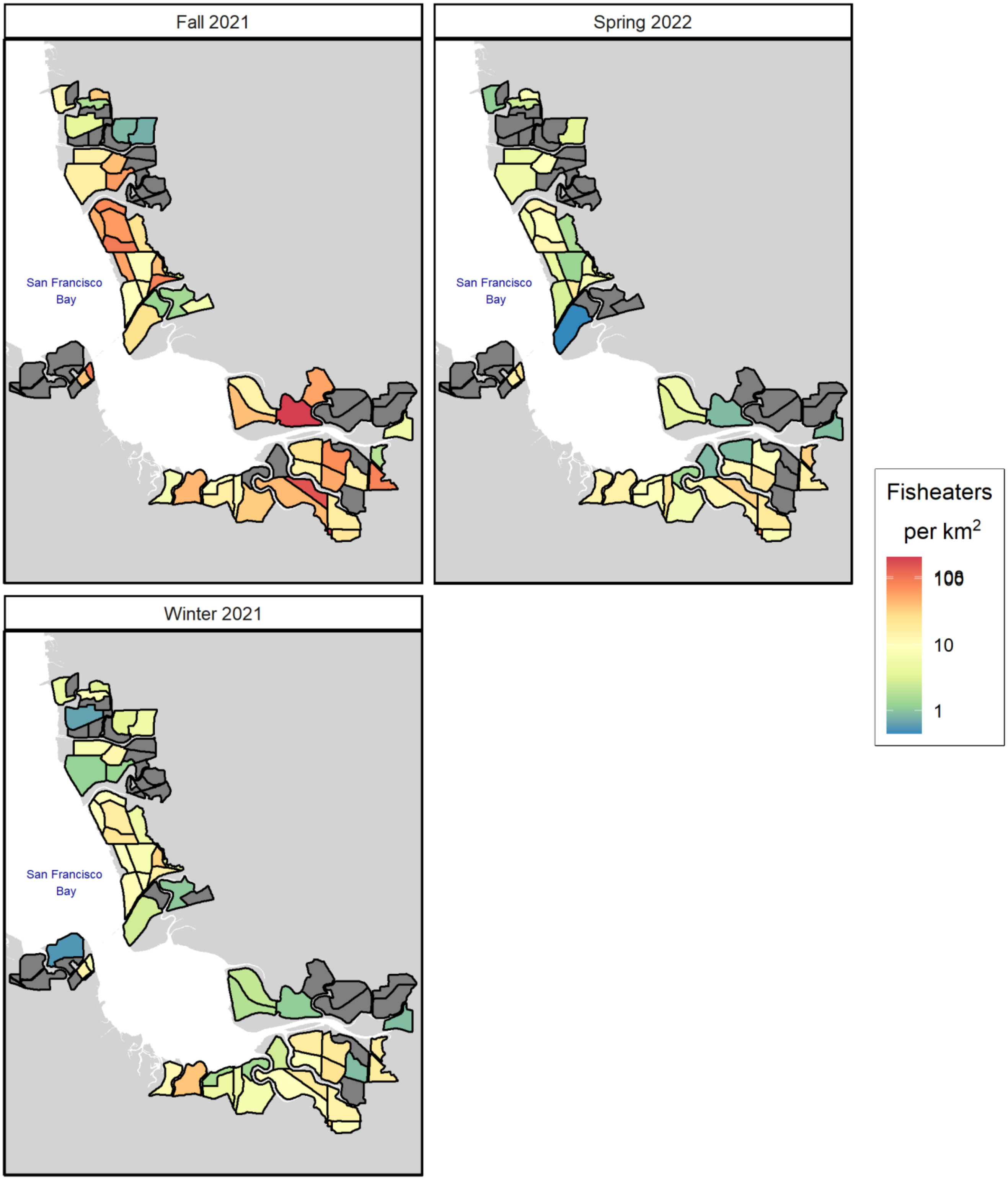

Figure 6. Density of fisheaters averaged across survey rounds by season, South San Francisco Bay, California; September 2021–May 2022. Dark grey ponds had no birds.

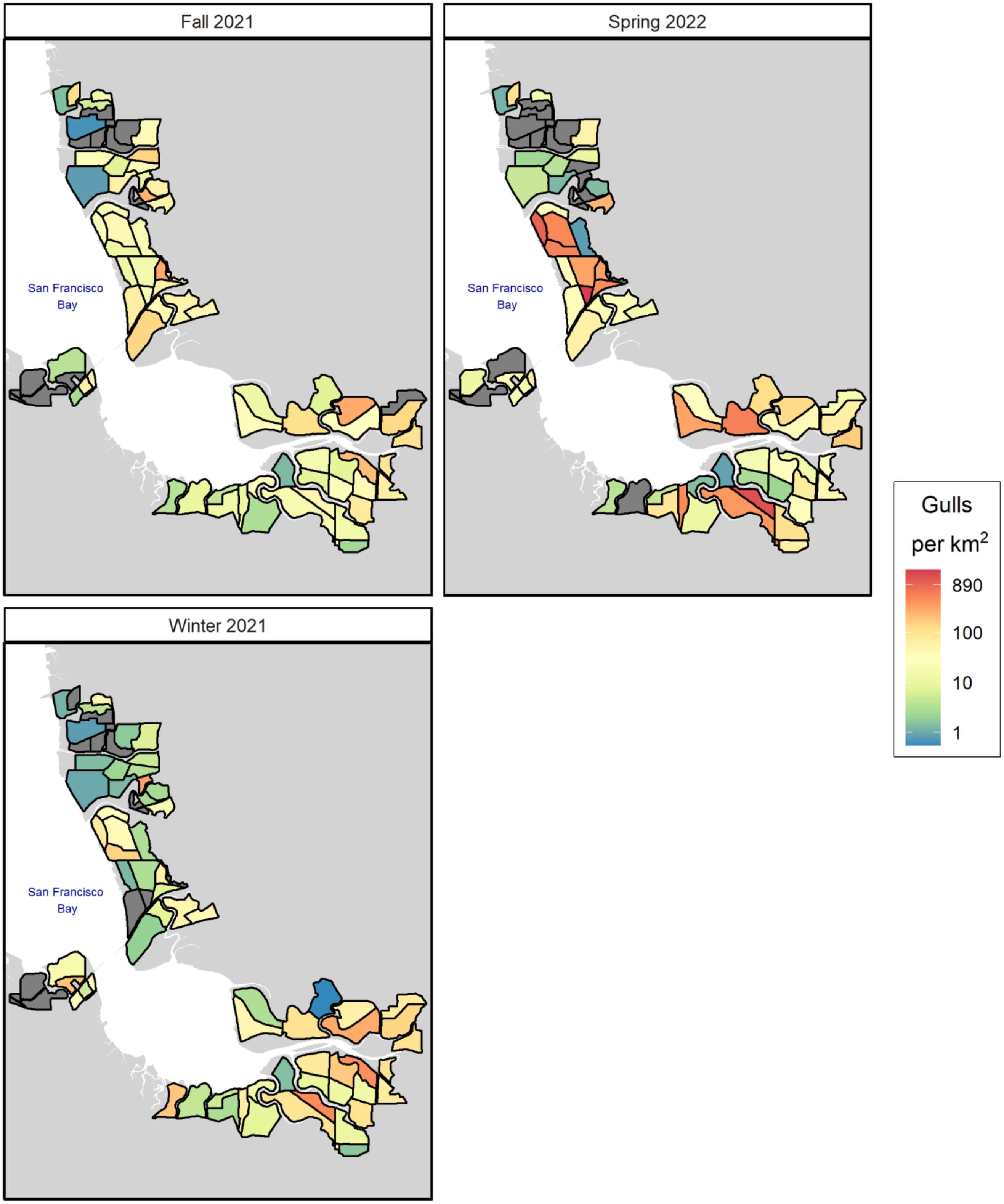

Figure 7. Density of gulls averaged across survey rounds by season, South San Francisco Bay, California; September 2021–May 2022. Dark grey ponds had no birds.

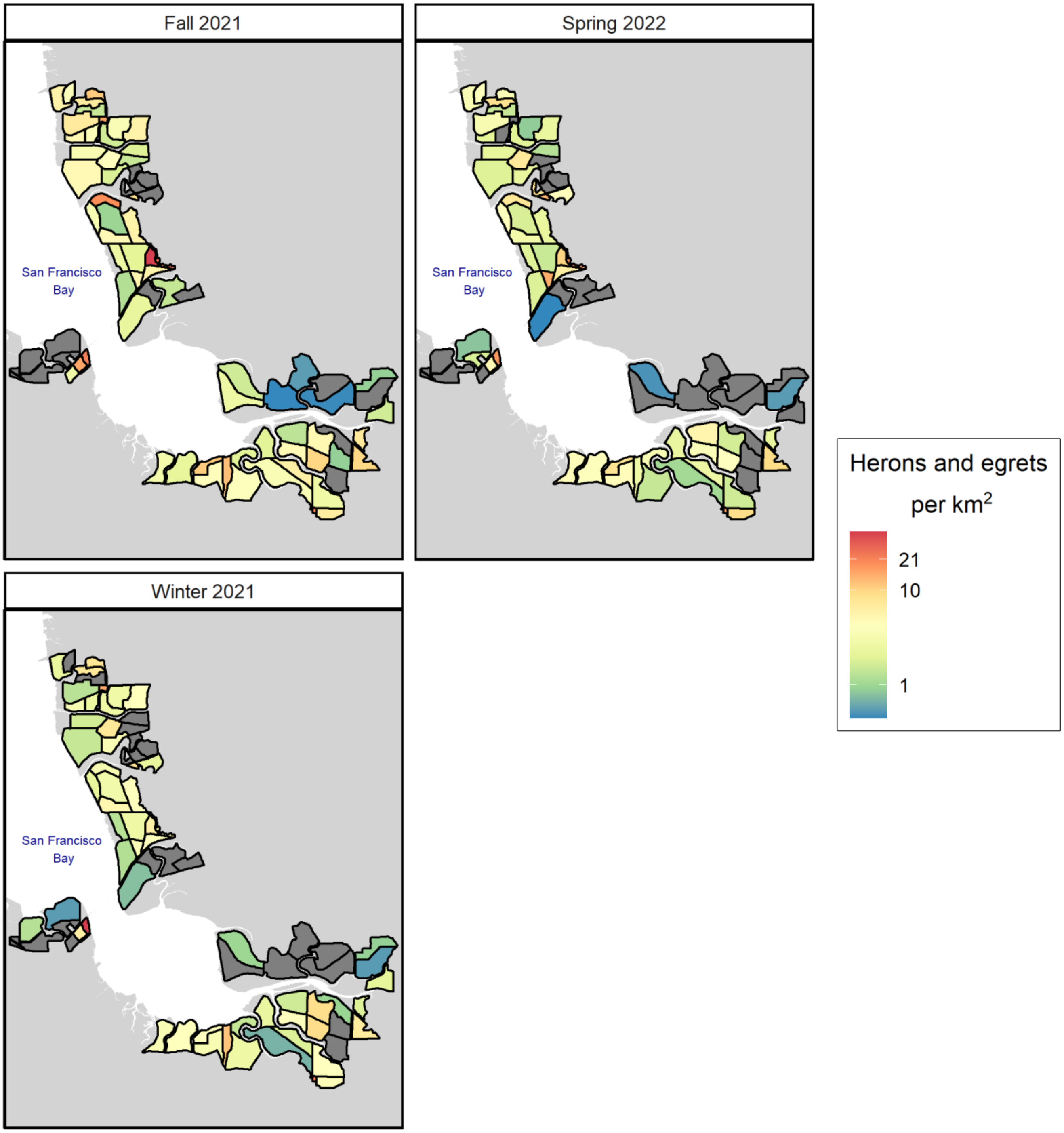

Figure 8. Density of herons and egrets averaged across survey rounds by season, South San Francisco Bay, California; September 2021–May 2022. Dark grey ponds had no birds.

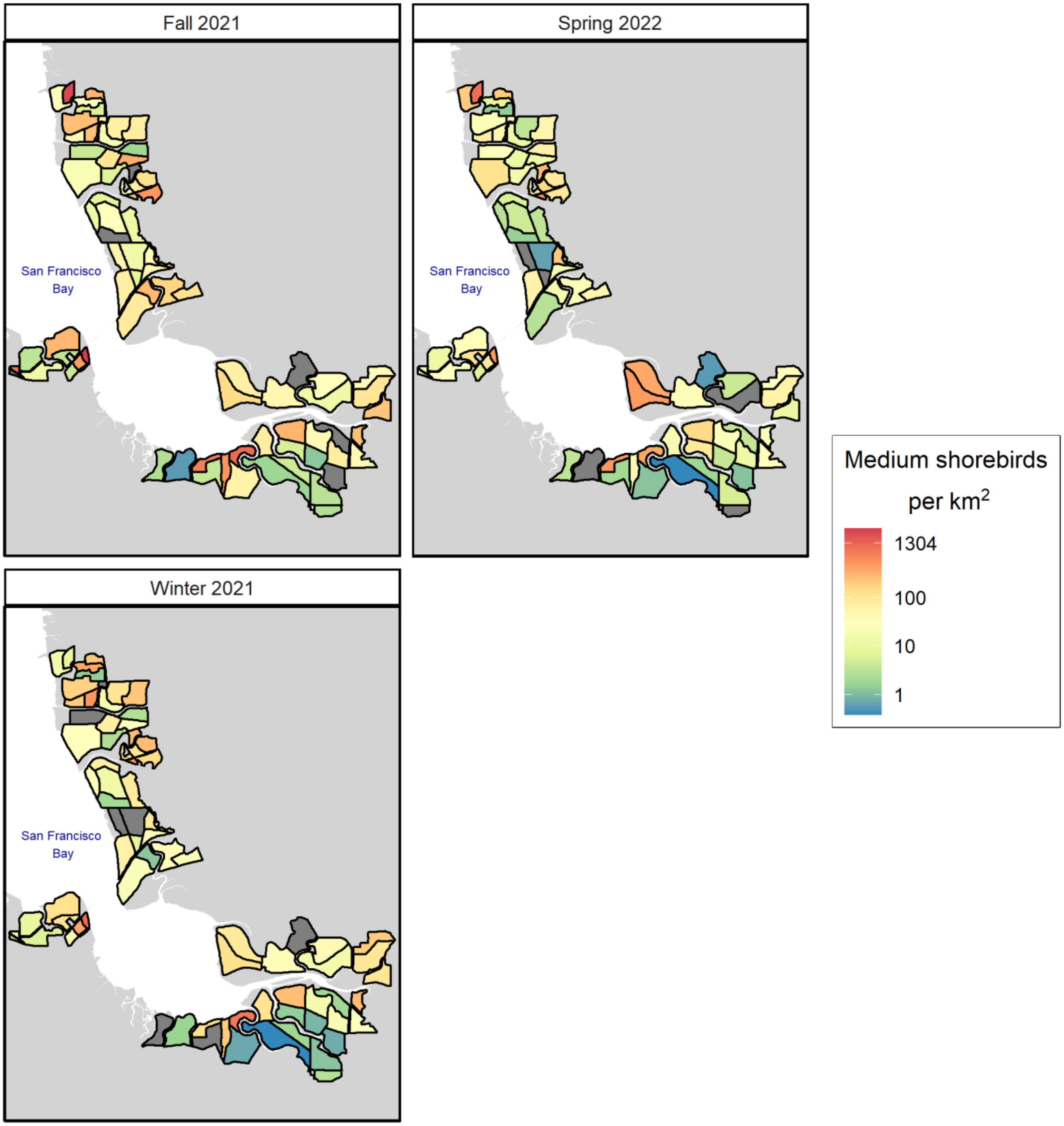

Figure 9. Density of medium shorebirds averaged across survey rounds by season, South San Francisco Bay, California; September 2021–May 2022. Dark grey ponds had no birds.

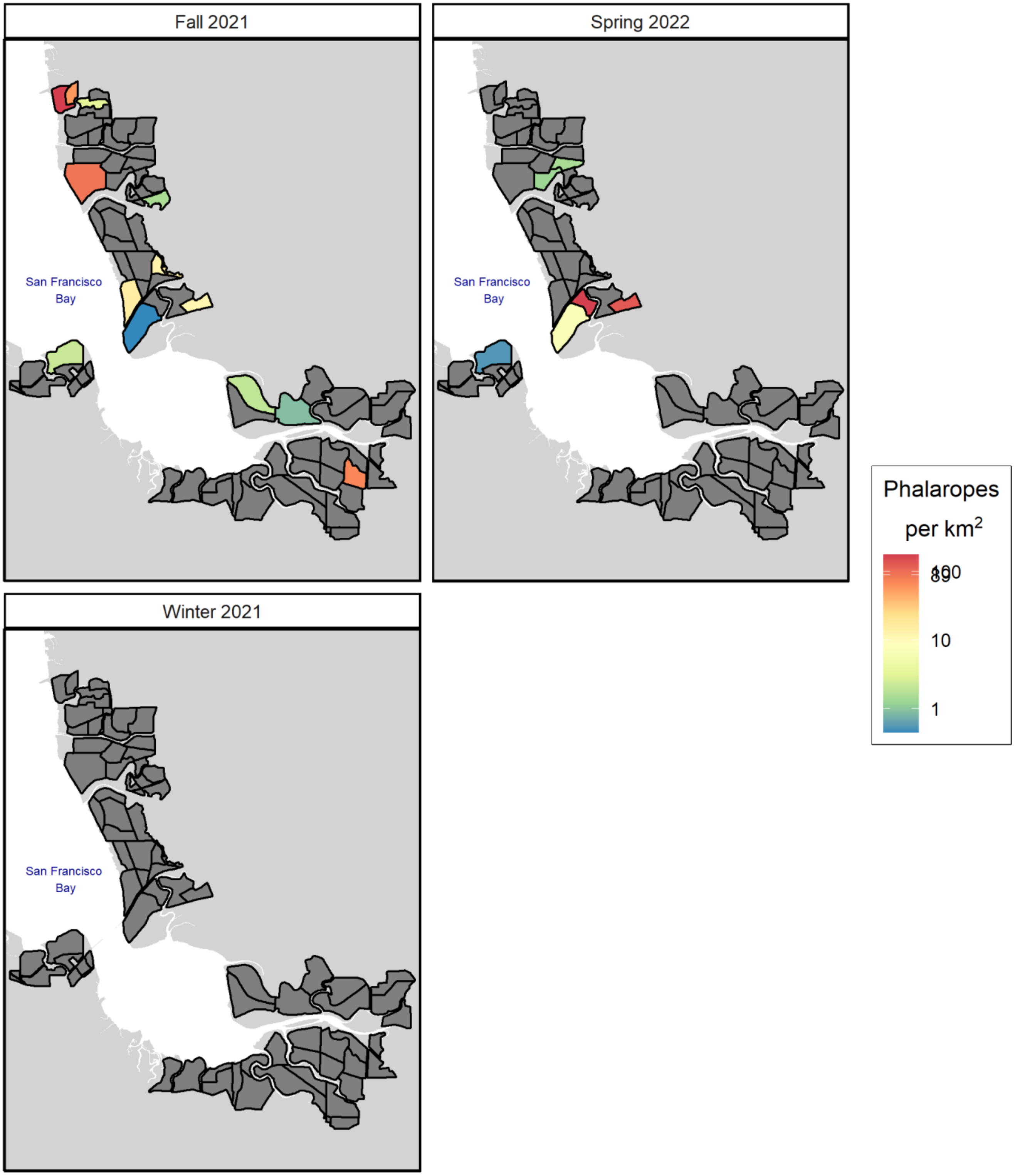

Figure 10. Density of phalaropes averaged across survey rounds by season, South San Francisco Bay, California; September 2021–May 2022. Dark grey ponds had no birds.

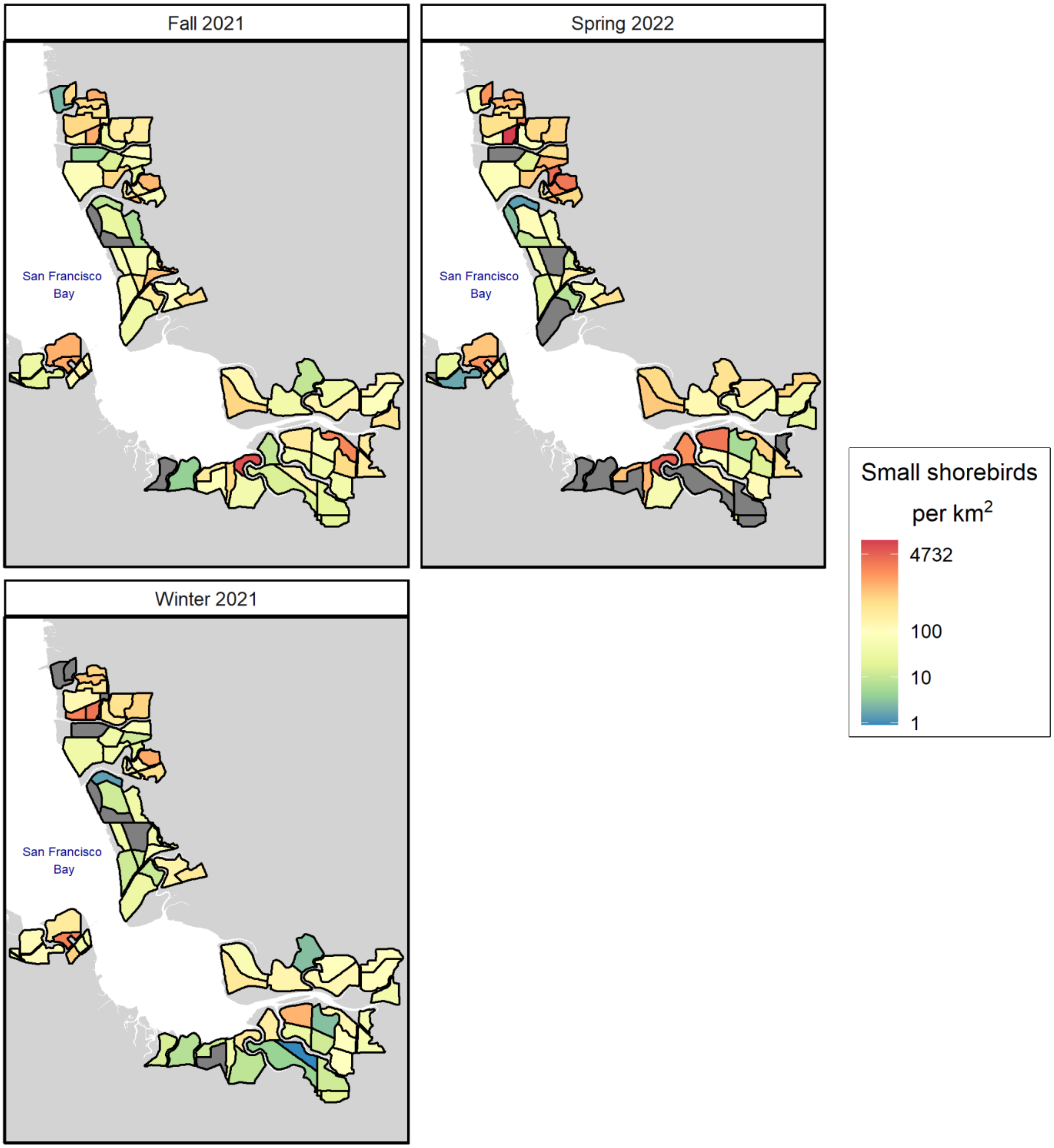

Figure 11. Density of small shorebirds averaged across survey rounds by season, South San Francisco Bay, California; September 2021–May 2022. Dark grey ponds had no birds.

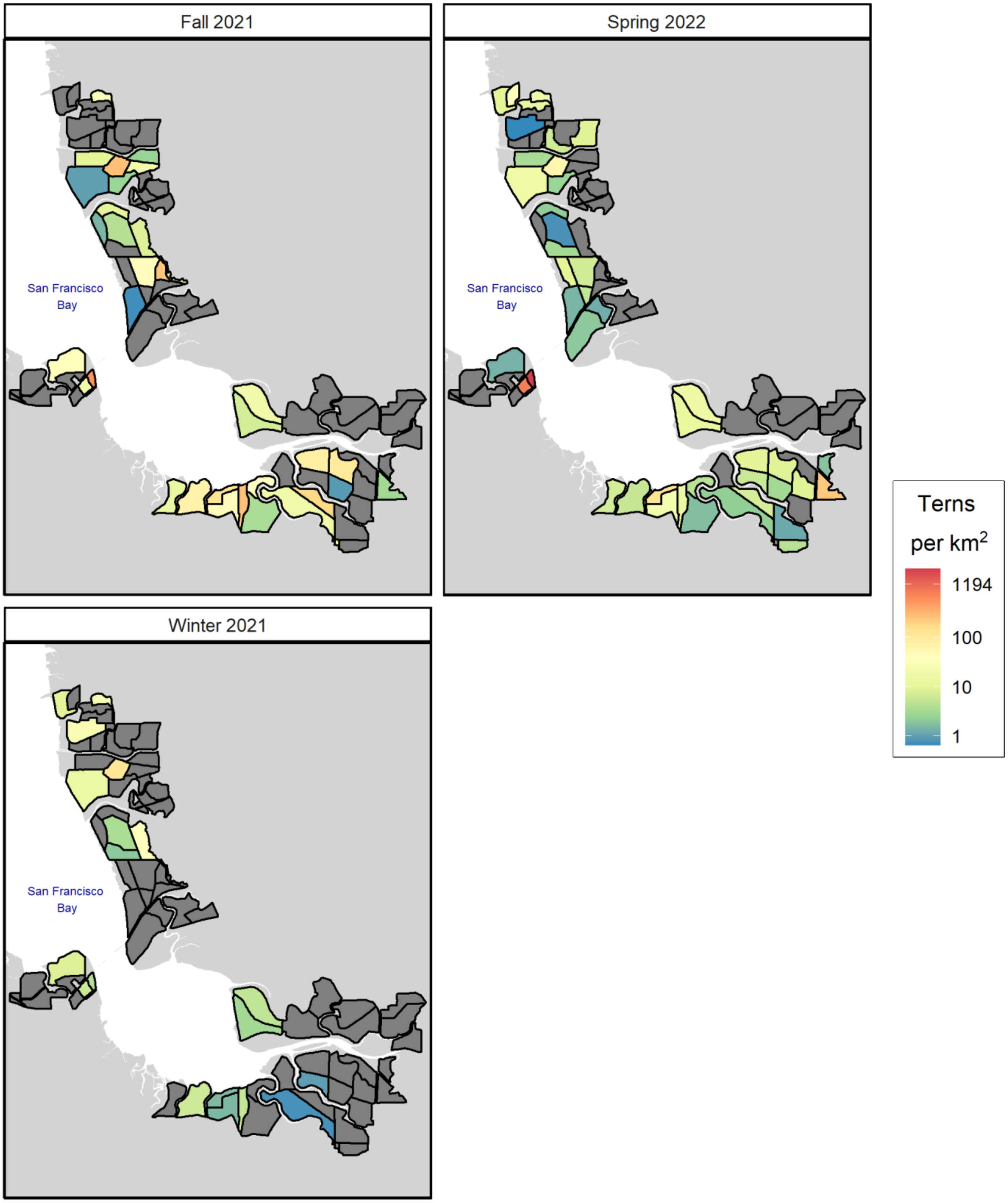

Figure 12. Density of terns averaged across survey rounds by season, South San Francisco Bay, California; September 2021–May 2022. Dark grey ponds had no birds.

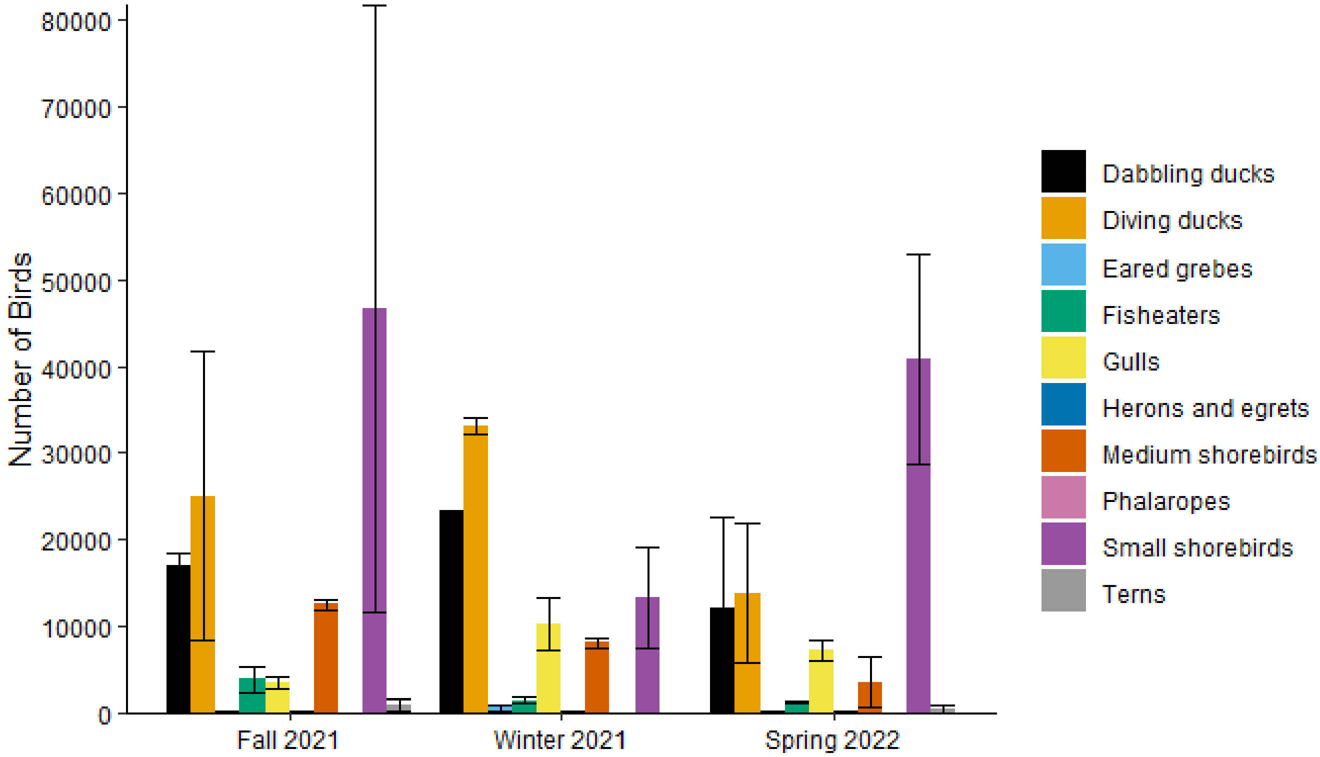

Figure 13. Avian abundance (mean number of bird sightings +/- 1 SE) by guild and by season at the Alviso complex, South San Francisco Bay, California; September 2021–May 2022. Scales on vertical axis are unique for each complex (Figure 13–Figure 18).

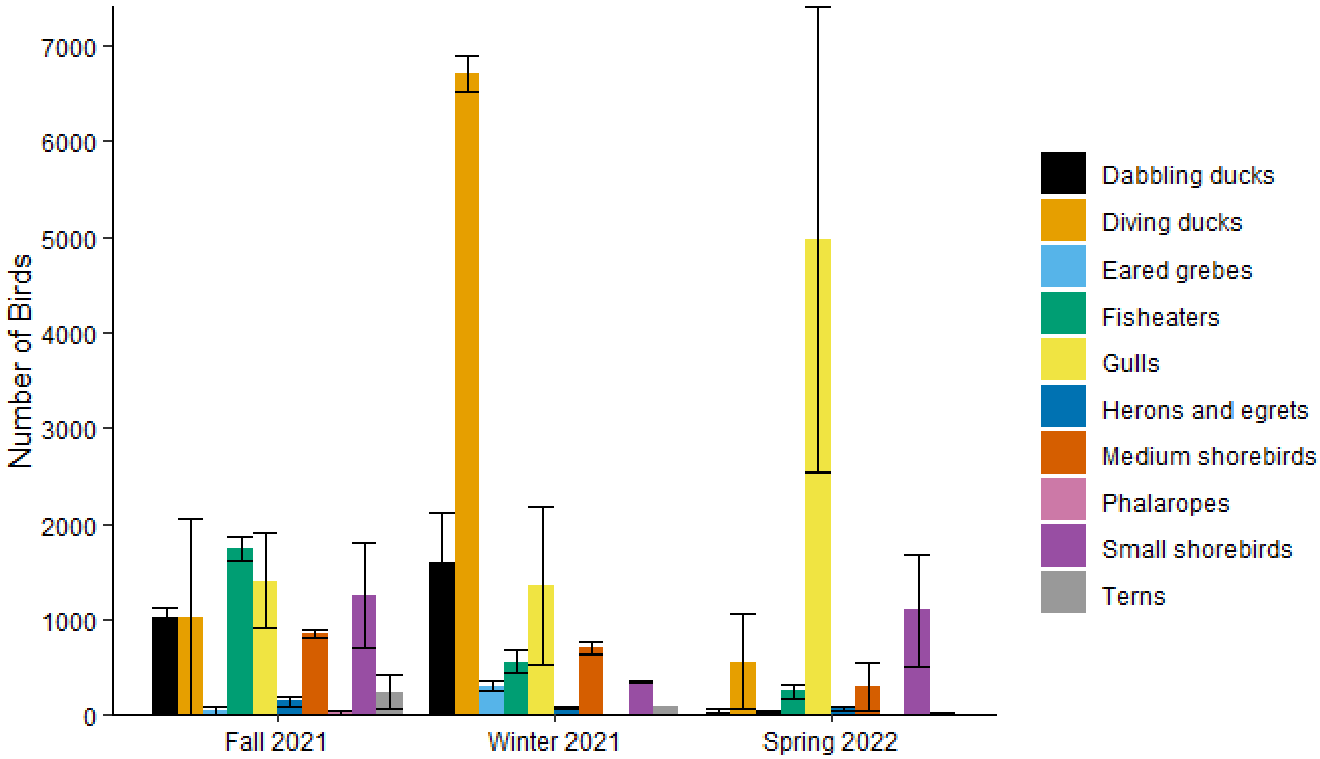

Figure 14. Avian abundance (mean number of bird sightings +/- 1 SE) by guild and by season at the Coyote Hills complex, South San Francisco Bay, California; September 2021–May 2022. Scales on vertical axis are unique for each complex (Figure 13–Figure 18).

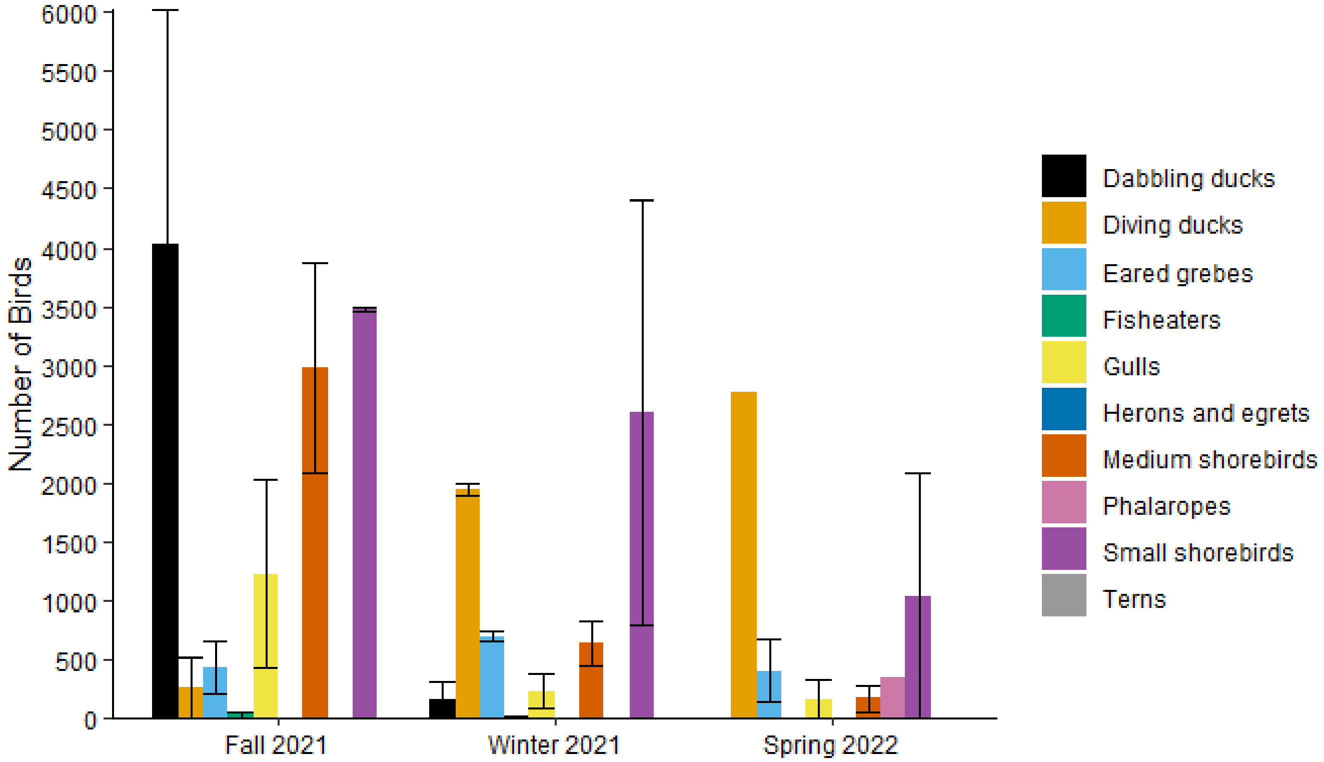

Figure 15. Avian abundance (mean number of bird sightings +/- 1 SE) by guild and by season at the Dumbarton complex, South San Francisco Bay, California; September 2021–May 2022. Scales on vertical axis are unique for each complex (Figure 13–Figure 18).

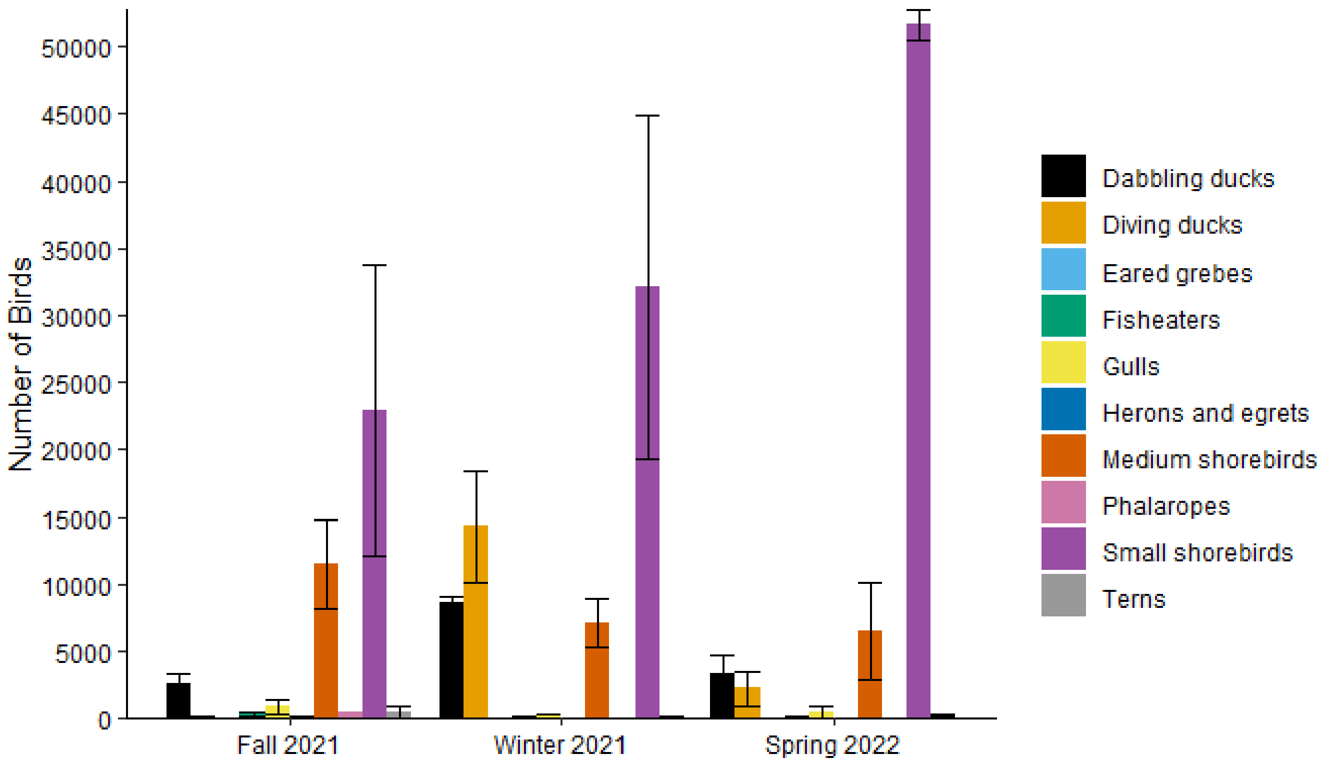

Figure 16. Avian abundance (mean number of bird sightings +/- 1 SE) by guild and by season at the Eden Landing complex, South San Francisco Bay, California; September 2021–May 2022. Scales on vertical axis are unique for each complex (Figure 13–Figure 18).

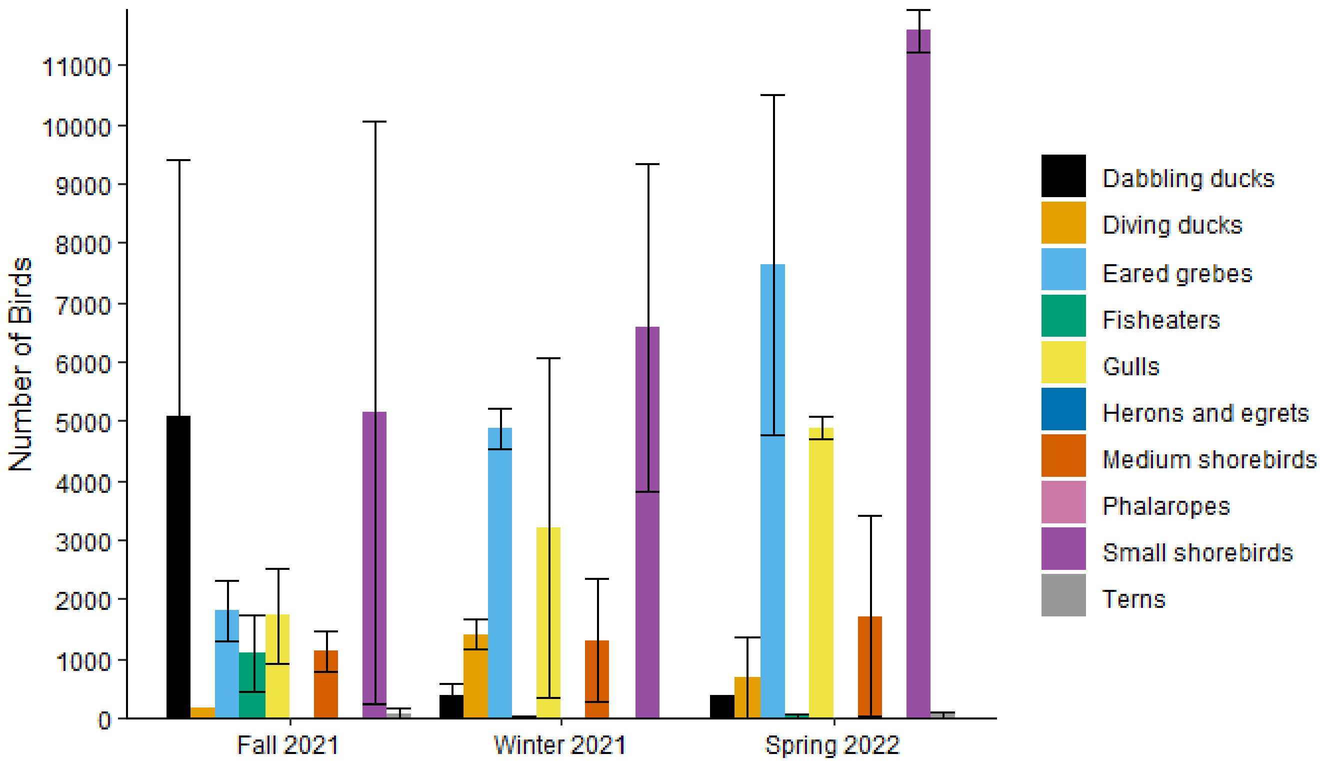

Figure 17. Avian abundance (mean number of bird sightings +/- 1 SE) by guild and by season at the Mowry complex, South San Francisco Bay, California; September 2021–May 2022. Scales on vertical axis are unique for each complex (Figure 13–Figure 18).

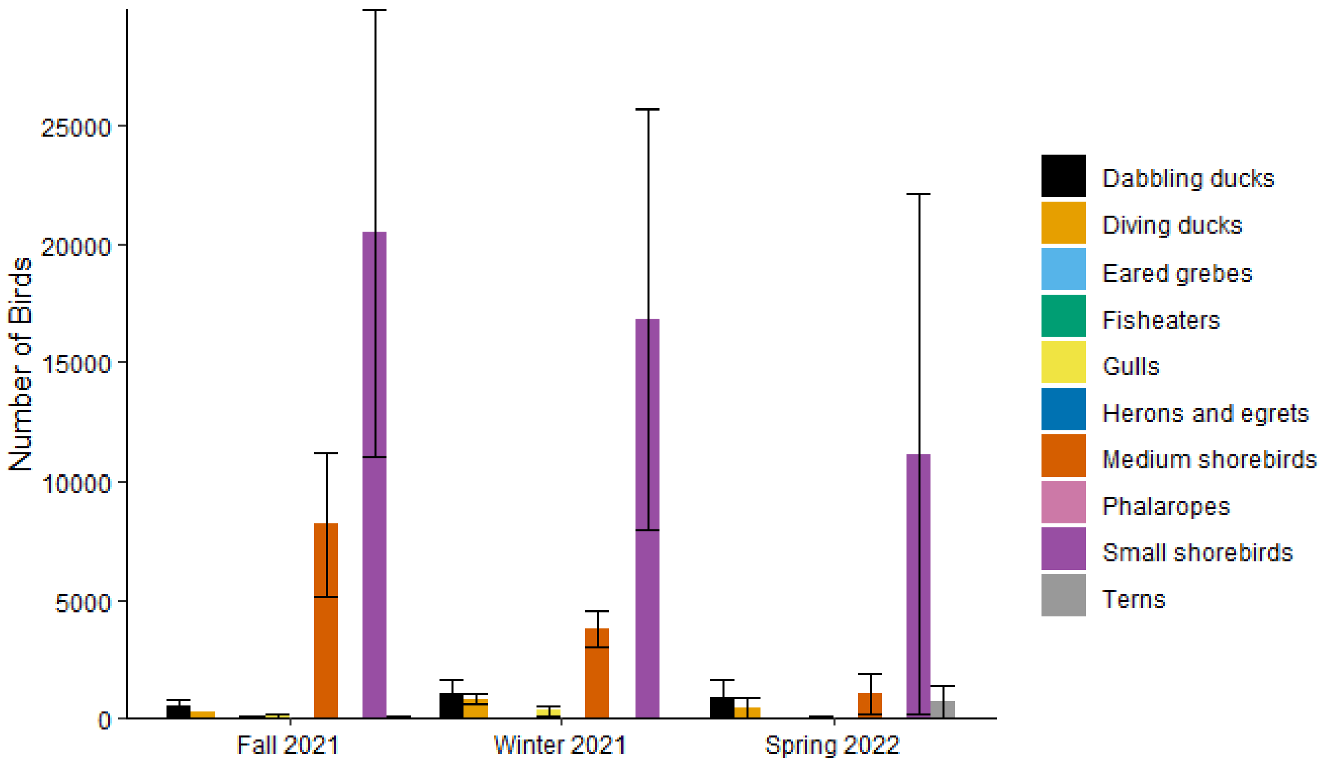

Figure 18. Avian abundance (mean number of bird sightings +/- 1 SE) by guild and by season at the Ravenswood complex, South San Francisco Bay, California; September 2021–May 2022. Scales on vertical axis are unique for each complex (Figure 13–Figure 18).

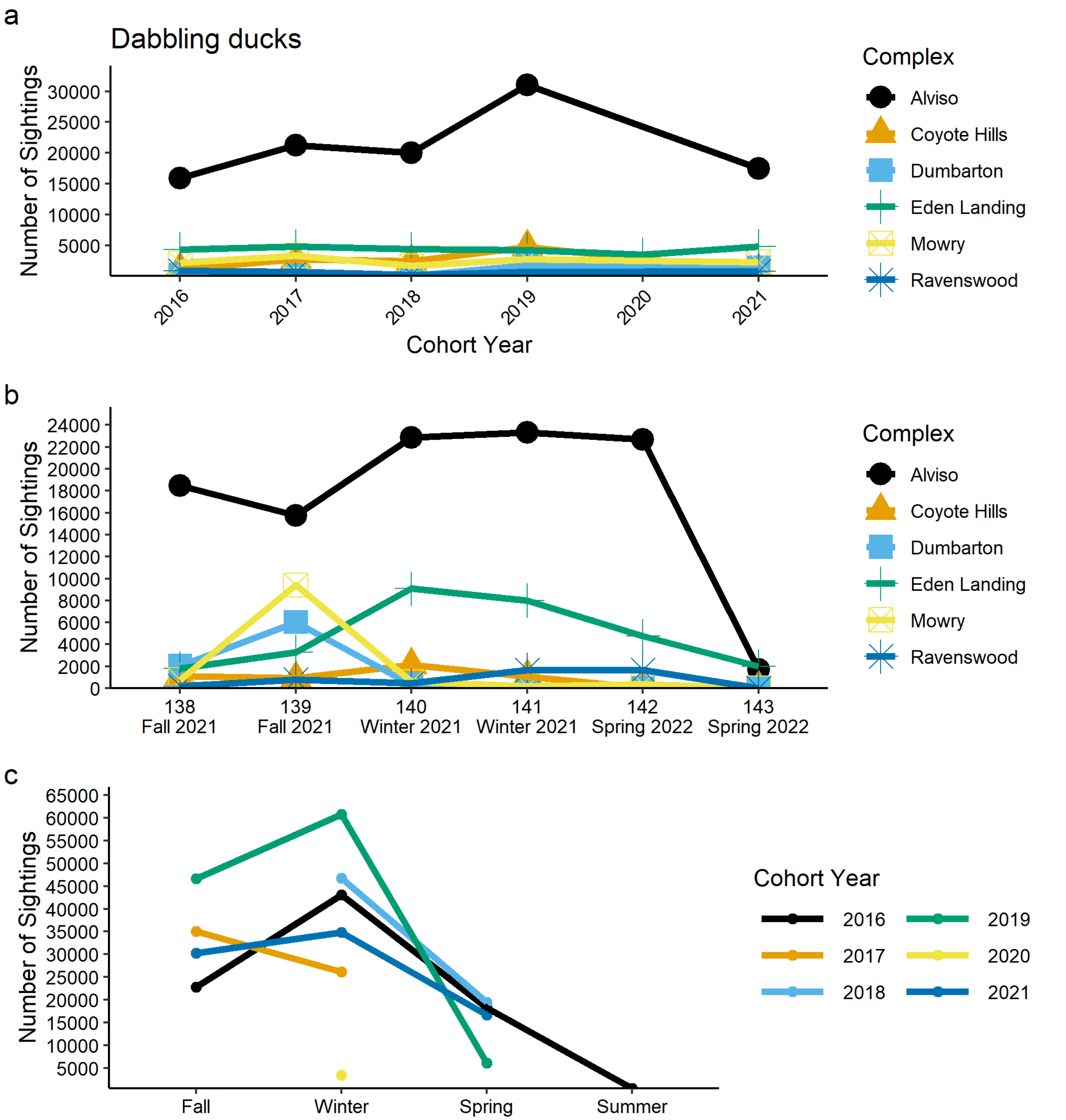

Figure 19. Abundance of dabbling ducks by (a) study year (September to August of the following year) for each complex (averaged across surveys), (b) survey period for each complex during the current report period (September 2021 – May 2022), and (c) season for each study year at all salt production ponds combined; South San Francisco Bay, California, Sept. 2005 – May 2022 (averaged across surveys). Study years 2019 and 2020 contain incomplete surveys rounds; see the Introduction for details.

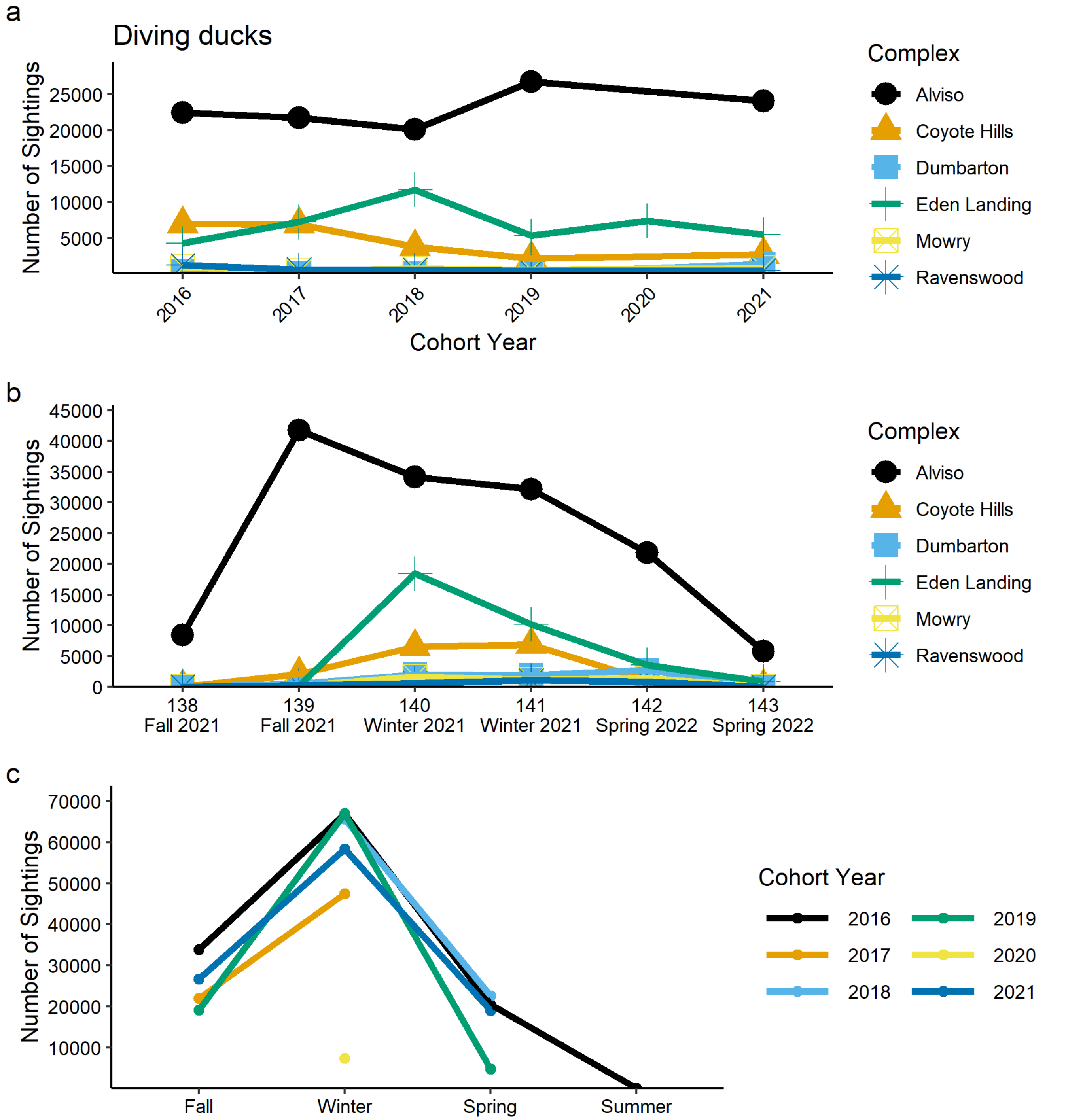

Figure 20. Abundance of diving ducks by (a) study year (September to August of the following year) for each complex (averaged across surveys), (b) survey period for each complex during the current report period (September 2021 – May 2022), and (c) season for each study year at all salt production ponds combined; South San Francisco Bay, California, Sept. 2005 – May 2022 (averaged across surveys). Study years 2019 and 2020 contain incomplete surveys rounds; see the Introduction for details.

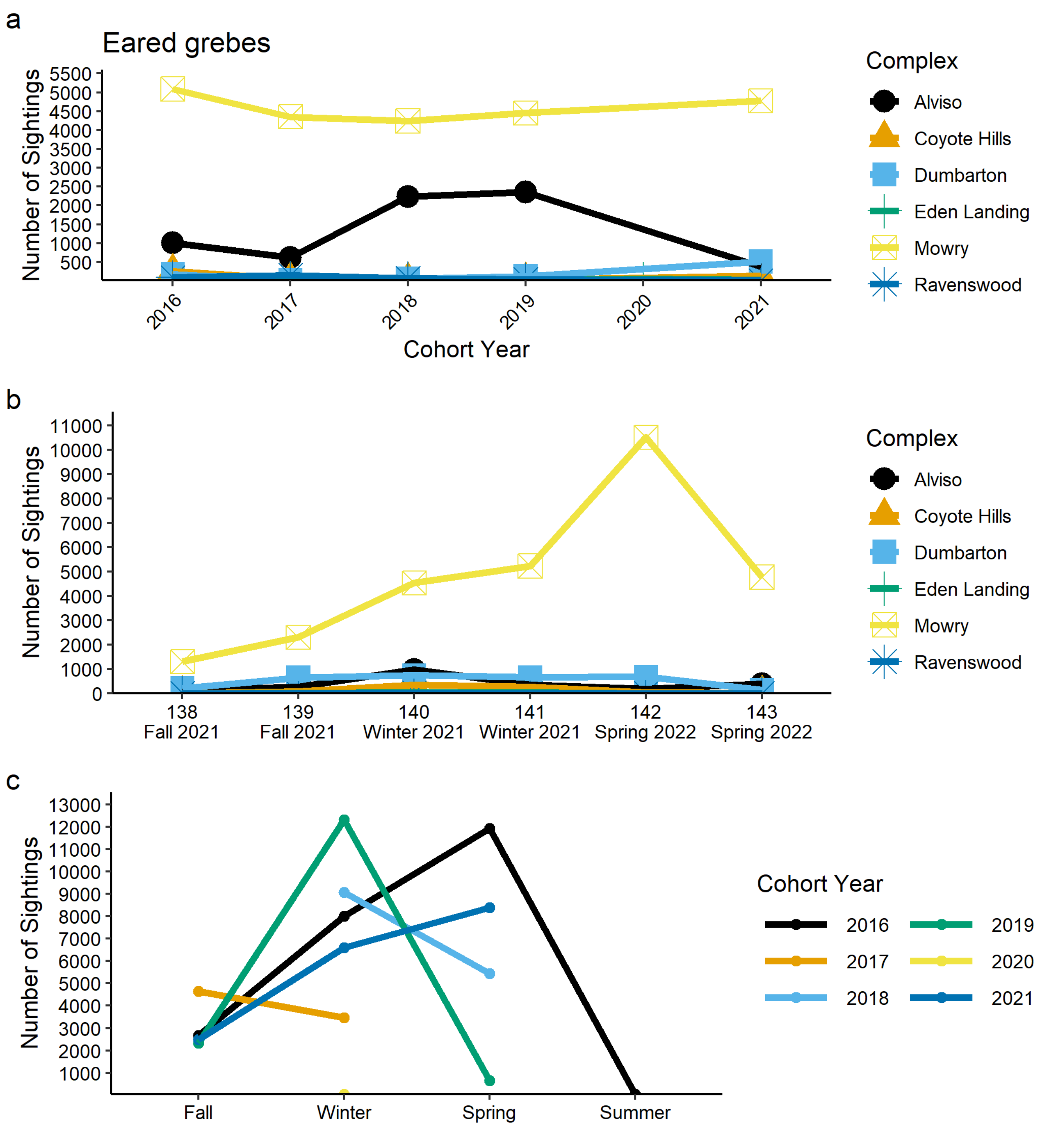

Figure 21. Abundance of eared grebes by (a) study year (September to August of the following year) for each complex (averaged across surveys), (b) survey period for each complex during the current report period (September 2021 – May 2022), and (c) season for each study year at all salt production ponds combined; South San Francisco Bay, California, Sept. 2005 – May 2022 (averaged across surveys). Study years 2019 and 2020 contain incomplete surveys rounds; see the Introduction for details.

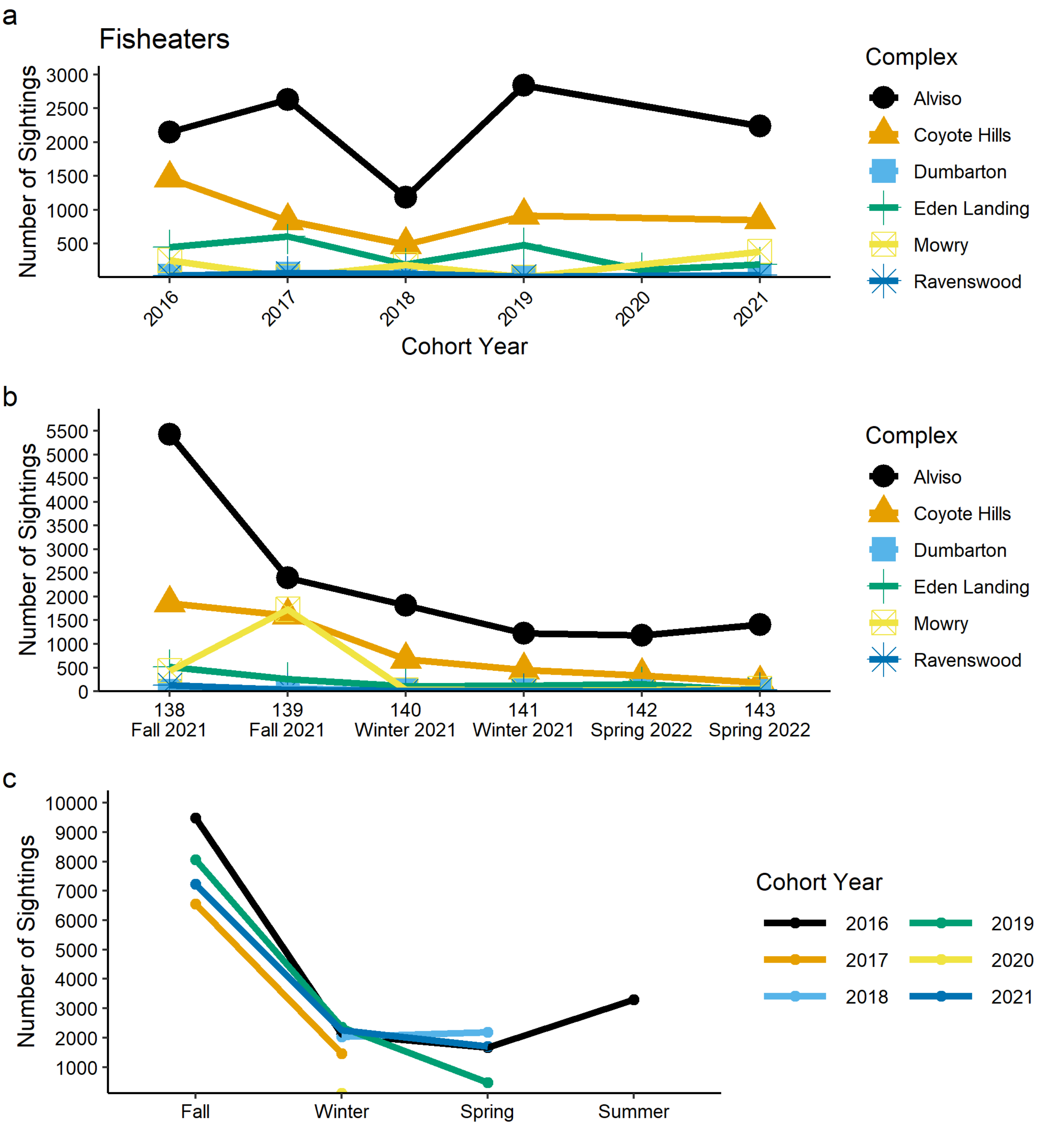

Figure 22. Abundance of fisheaters by (a) study year (September to August of the following year) for each complex (averaged across surveys), (b) survey period for each complex during the current report period (September 2021 – May 2022), and (c) season for each study year at all salt production ponds combined; South San Francisco Bay, California, Sept. 2005 – May 2022 (averaged across surveys). Study years 2019 and 2020 contain incomplete surveys rounds; see the Introduction for details.

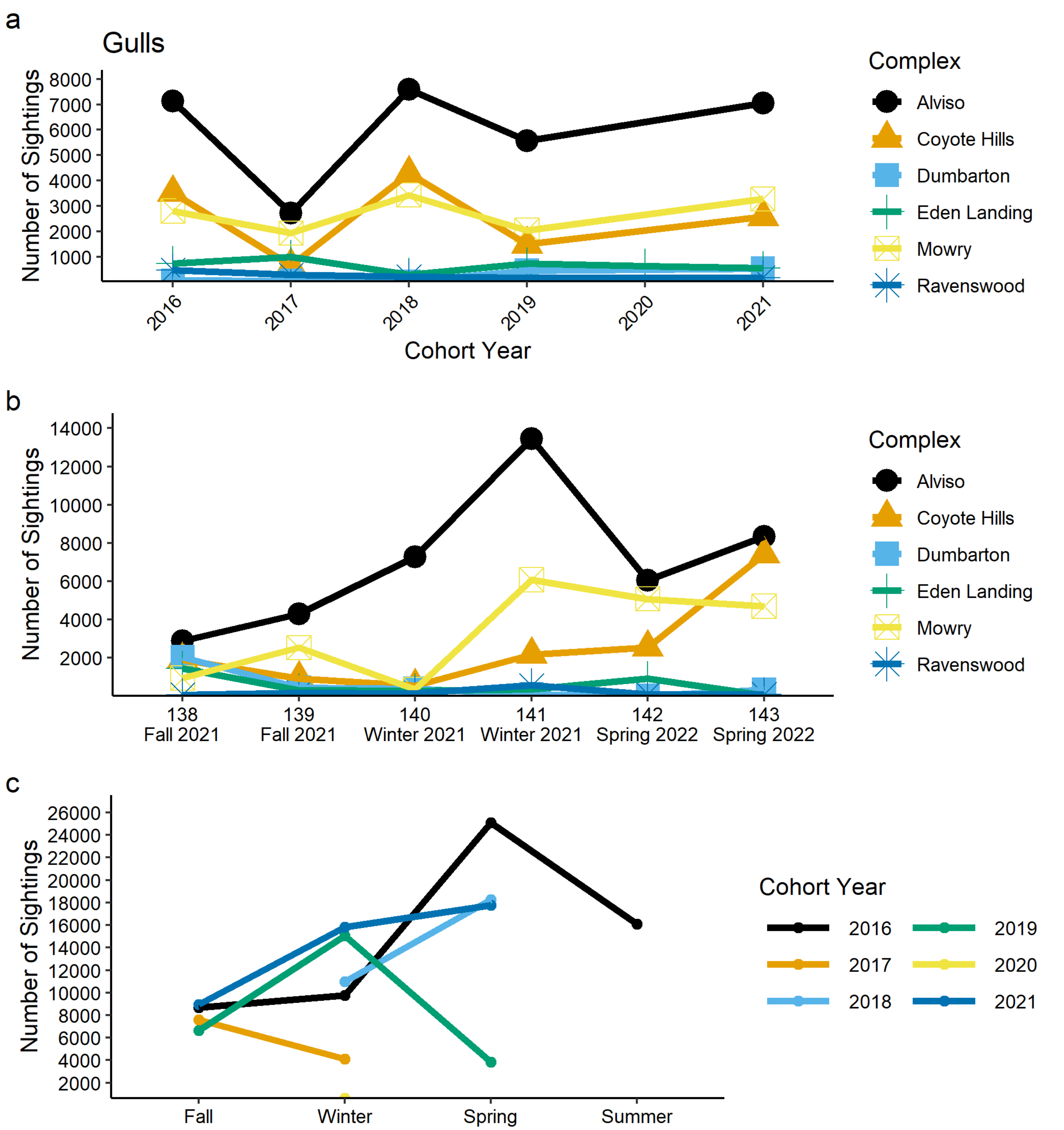

Figure 23. Abundance of gulls by (a) study year (September to August of the following year) for each complex (averaged across surveys), (b) survey period for each complex during the current report period (September 2021 – May 2022), and (c) season for each study year at all salt production ponds combined; South San Francisco Bay, California, Sept. 2005 – May 2022 (averaged across surveys). Study years 2019 and 2020 contain incomplete surveys rounds; see the Introduction for details.

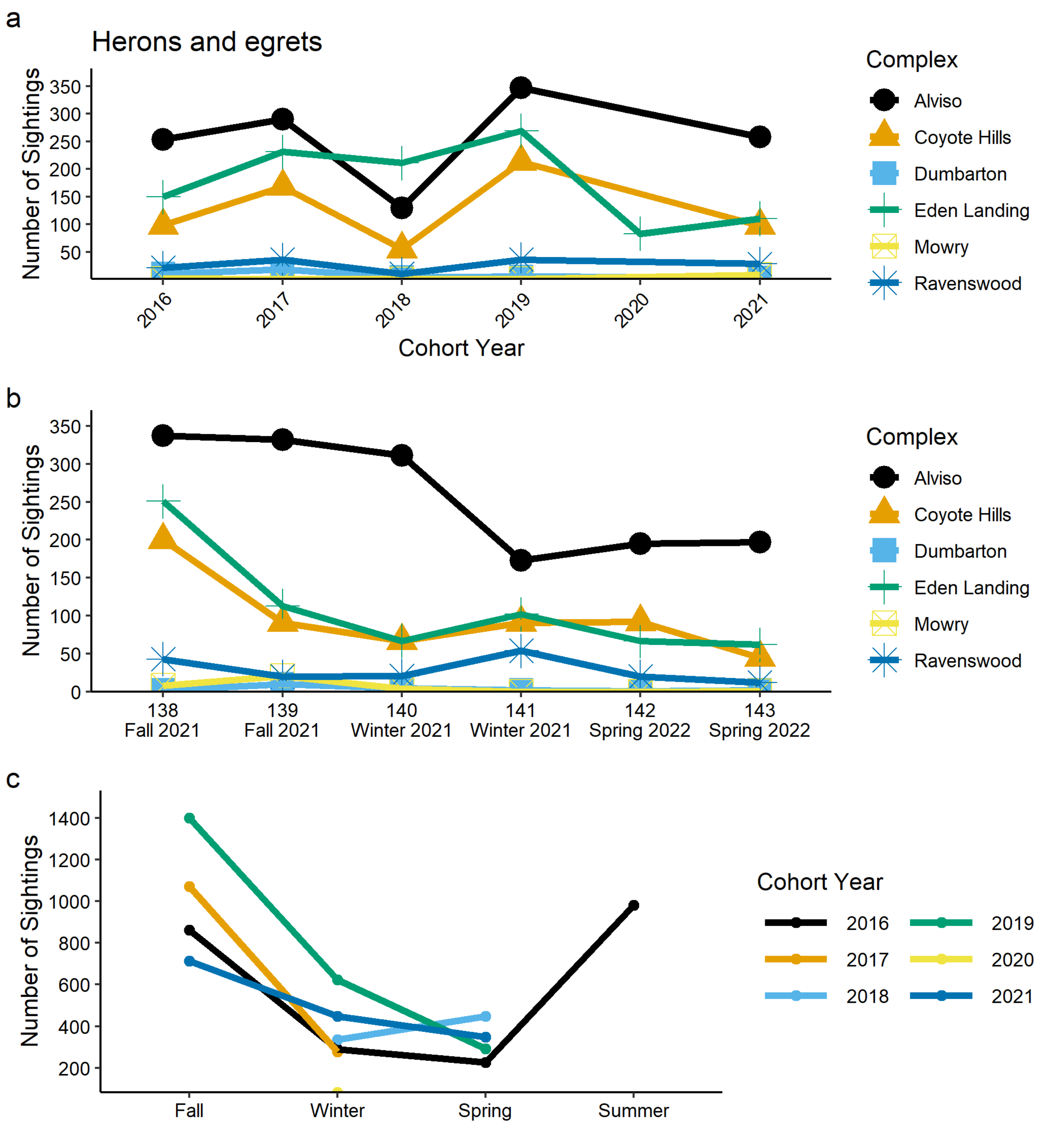

Figure 24. Abundance of herons and egrets by (a) study year (September to August of the following year) for each complex (averaged across surveys), (b) survey period for each complex during the current report period (September 2021 – May 2022), and (c) season for each study year at all salt production ponds combined; South San Francisco Bay, California, Sept. 2005 – May 2022 (averaged across surveys). Study years 2019 and 2020 contain incomplete surveys rounds; see the Introduction for details.

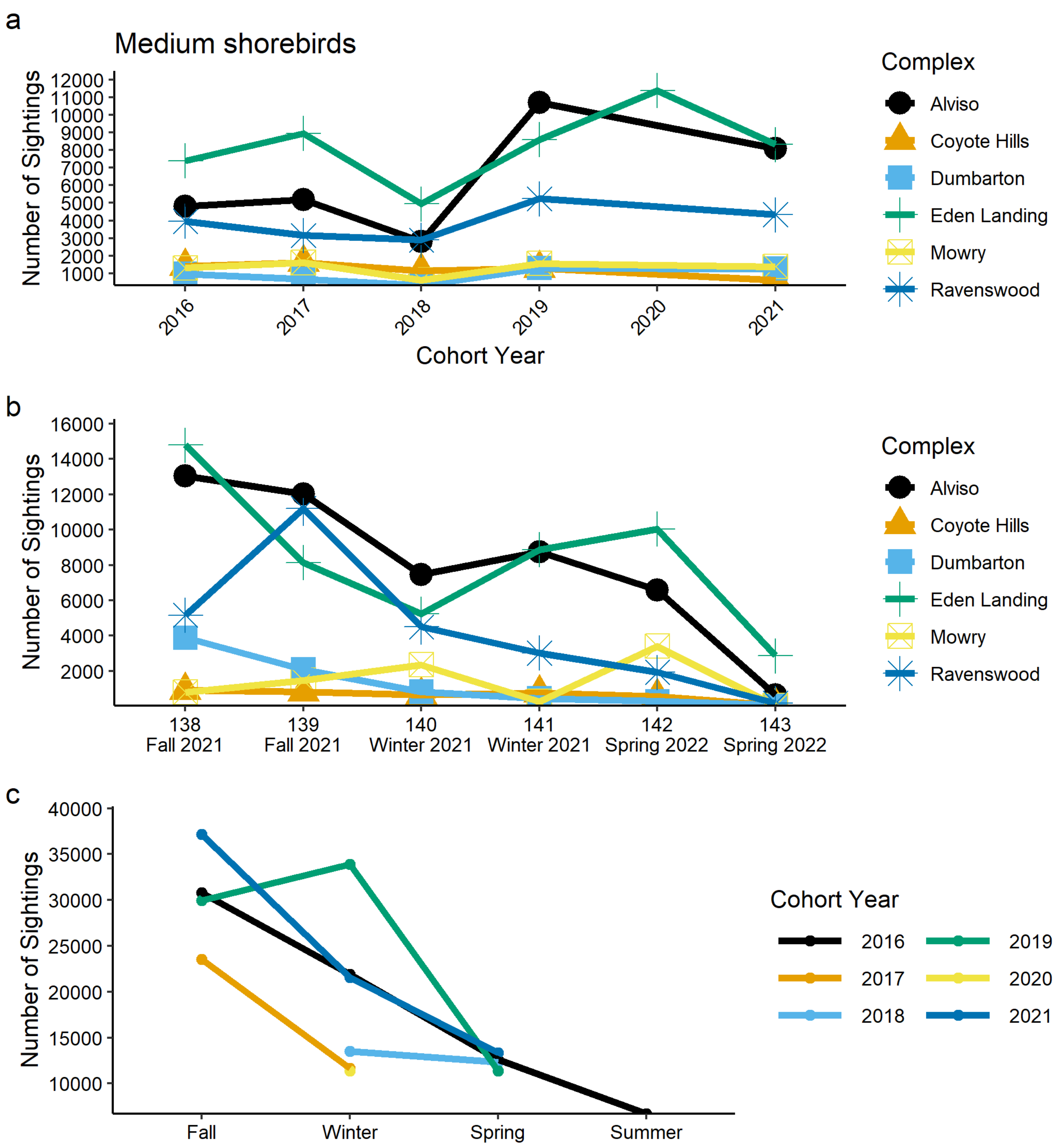

Figure 25. Abundance of medium shorebirds by (a) study year (September to August of the following year) for each complex (averaged across surveys), (b) survey period for each complex during the current report period (September 2021 – May 2022), and (c) season for each study year at all salt production ponds combined; South San Francisco Bay, California, Sept. 2005 – May 2022 (averaged across surveys). Study years 2019 and 2020 contain incomplete surveys rounds; see the Introduction for details.

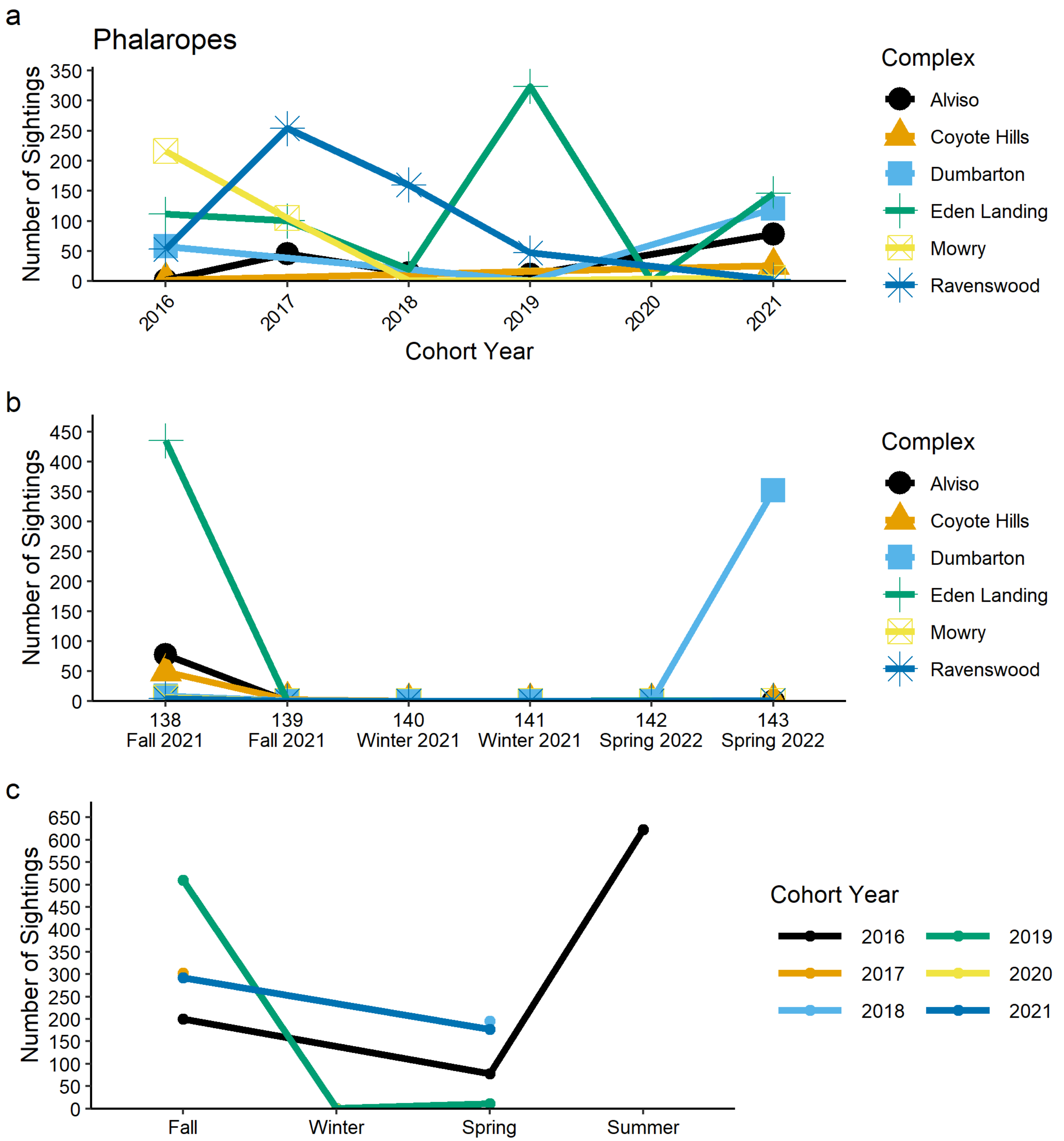

Figure 26. Abundance of phalaropes by (a) study year (September to August of the following year) for each complex (averaged across surveys), (b) survey period for each complex during the current report period (September 2021 – May 2022), and (c) season for each study year at all salt production ponds combined; South San Francisco Bay, California, Sept. 2005 – May 2022 (averaged across surveys). Study years 2019 and 2020 contain incomplete surveys rounds; see the Introduction for details.

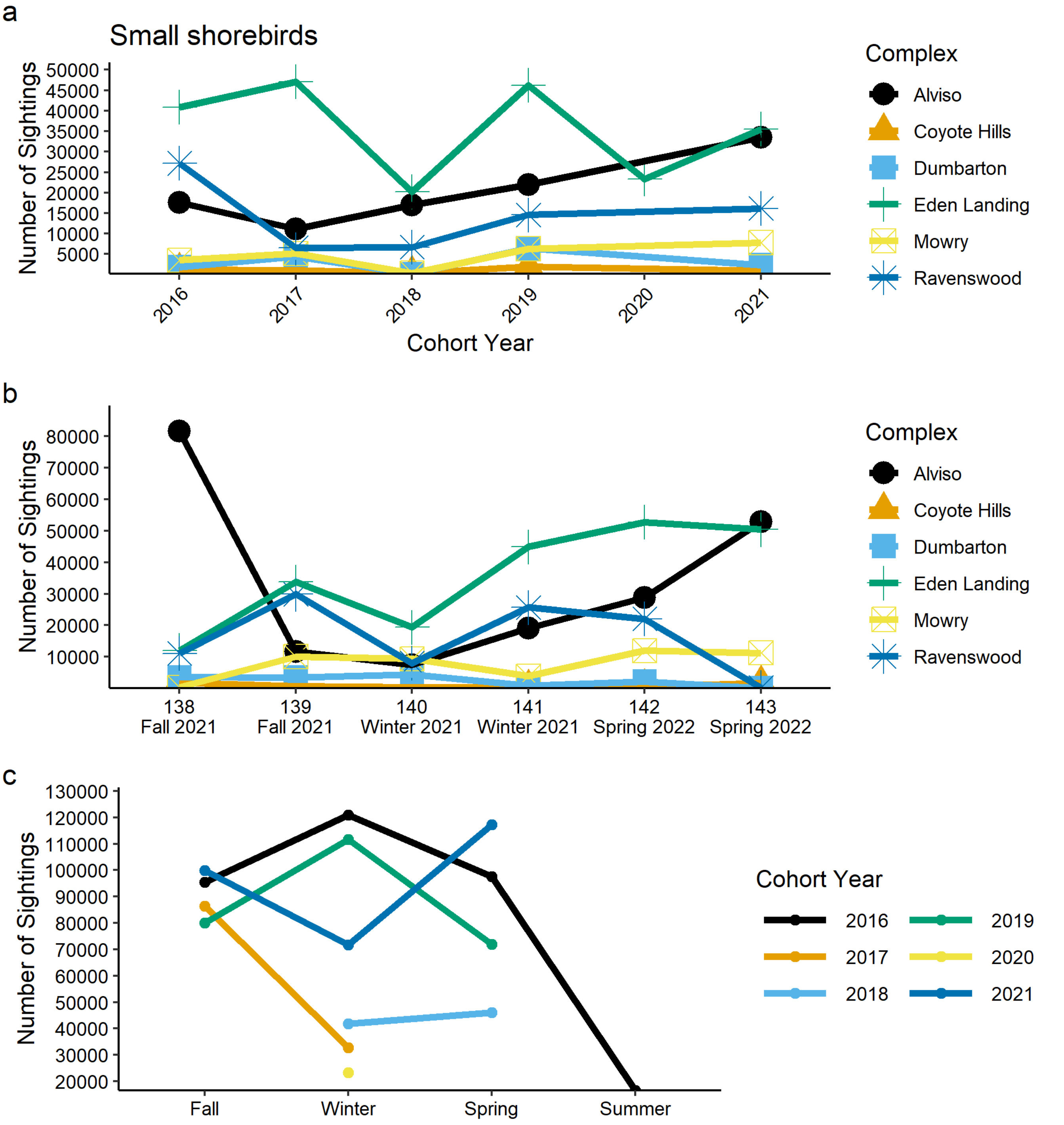

Figure 27. Abundance of small shorebirds by (a) study year (September to August of the following year) for each complex (averaged across surveys), (b) survey period for each complex during the current report period (September 2021 – May 2022), and (c) season for each study year at all salt production ponds combined; South San Francisco Bay, California, Sept. 2005 – May 2022 (averaged across surveys). Study years 2019 and 2020 contain incomplete surveys rounds; see the Introduction for details.

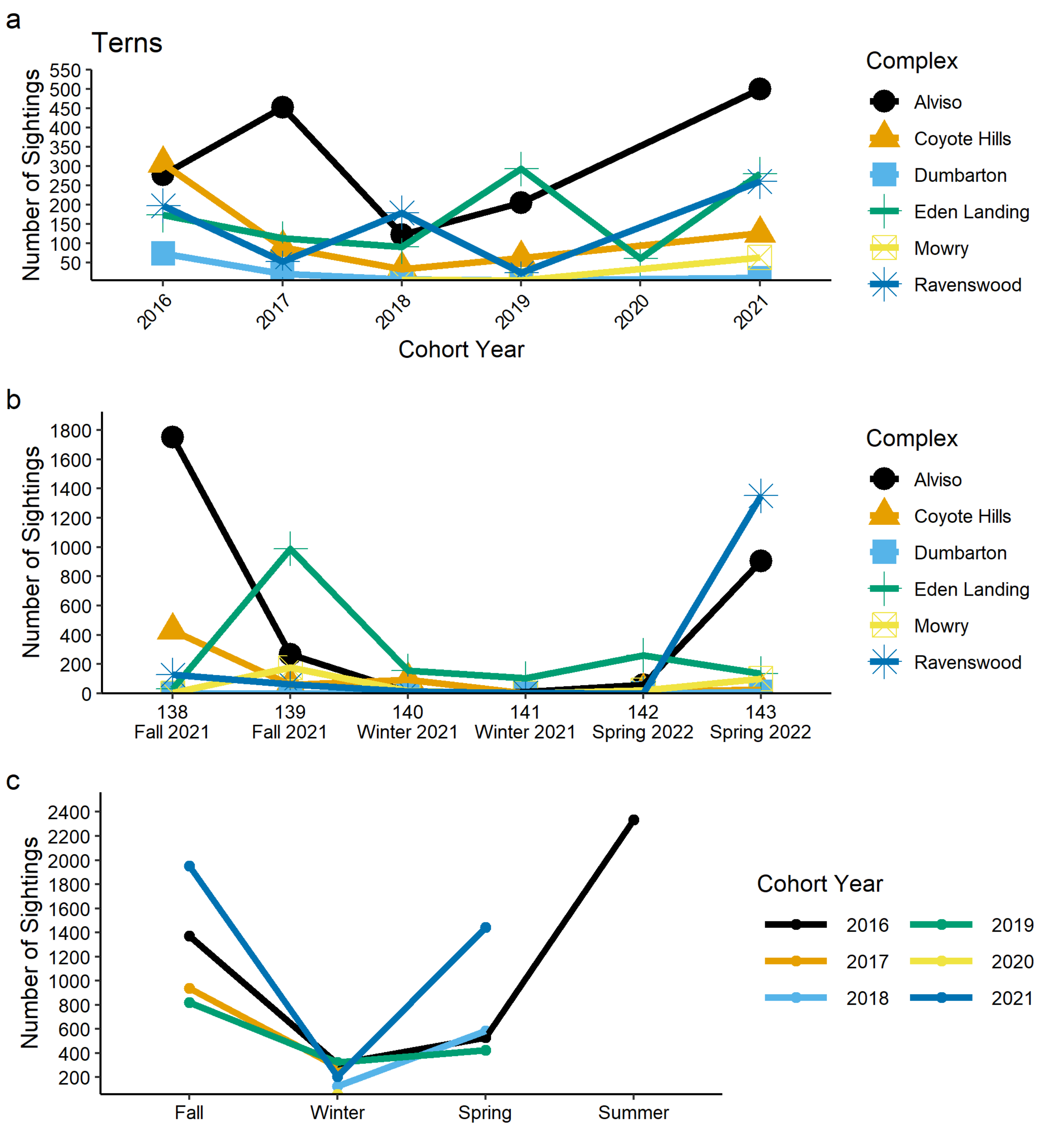

Figure 28. Abundance of terns by (a) study year (September to August of the following year) for each complex (averaged across surveys), (b) survey period for each complex during the current report period (September 2021 – May 2022), and (c) season for each study year at all salt production ponds combined; South San Francisco Bay, California, Sept. 2005 – May 2022 (averaged across surveys). Study years 2019 and 2020 contain incomplete surveys rounds; see the Introduction for details.

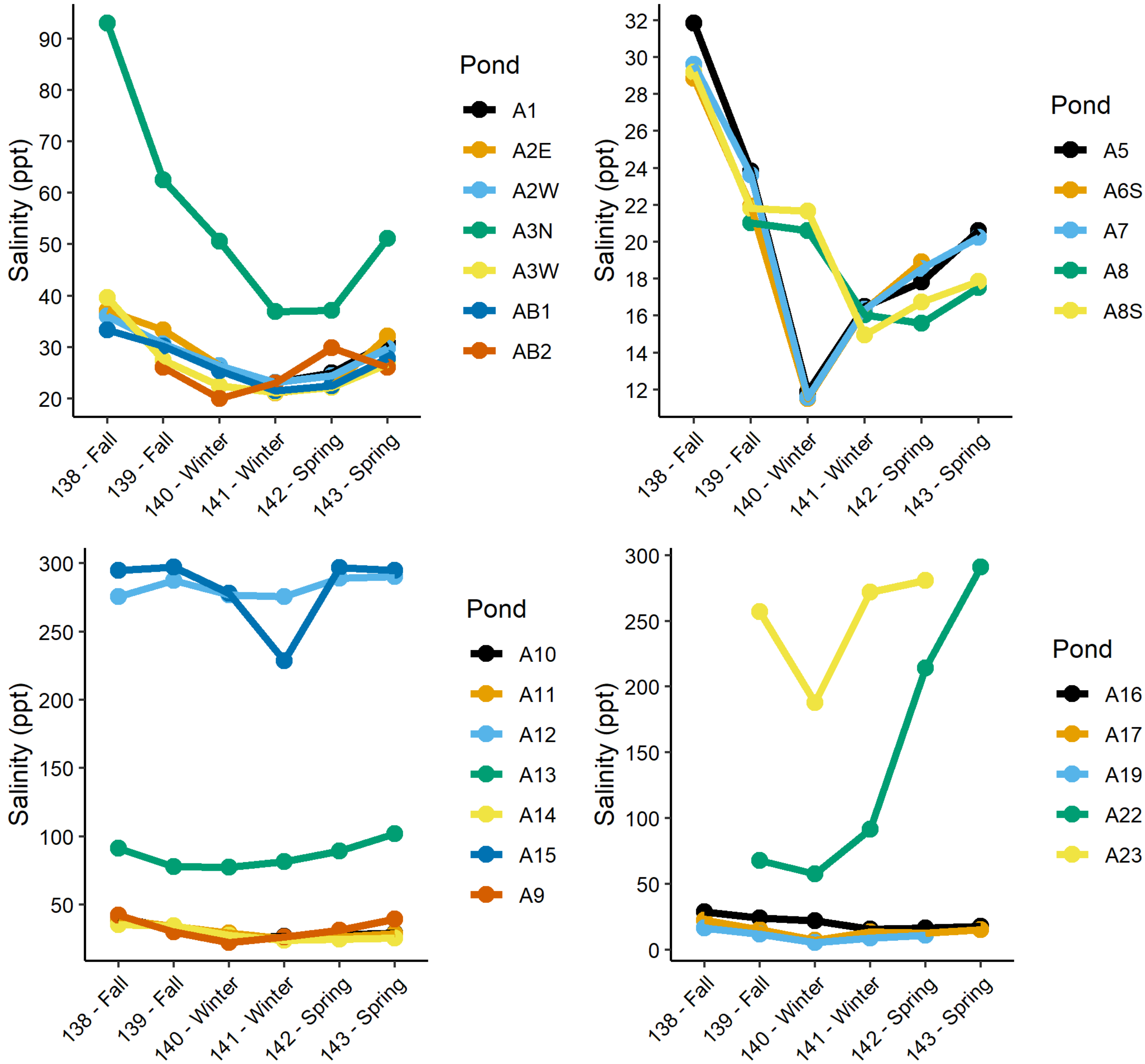

Figure 29. Average Salinity (ppt) at the Alviso pond complex, South San Francisco Bay, California; September 2021 – May 2022. Scale differs between graphs.

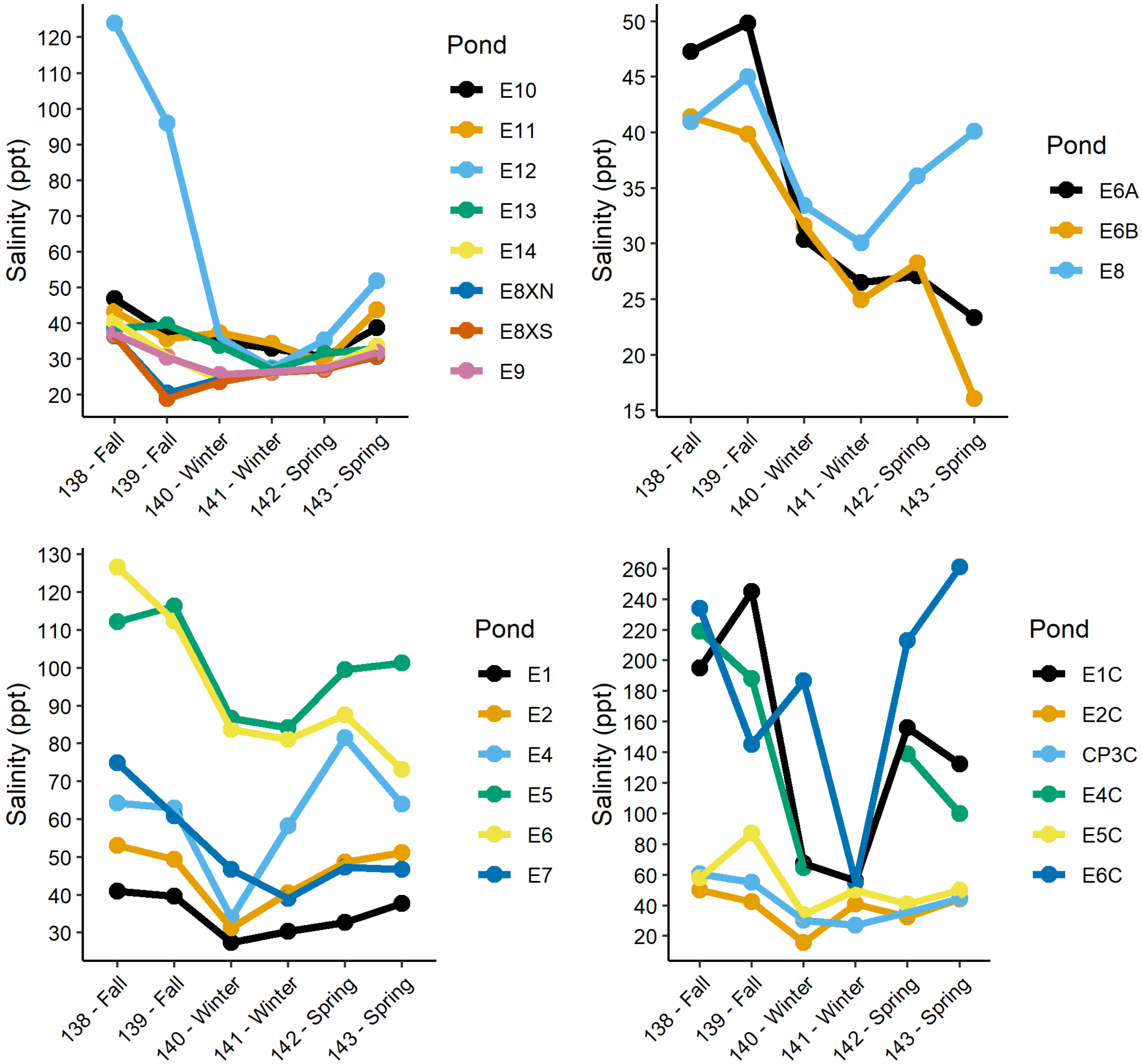

Figure 30. Average Salinity (ppt) at the Eden Landing pond complex, South San Francisco Bay, California; September 2021 – May 2022. Scale differs between graphs.

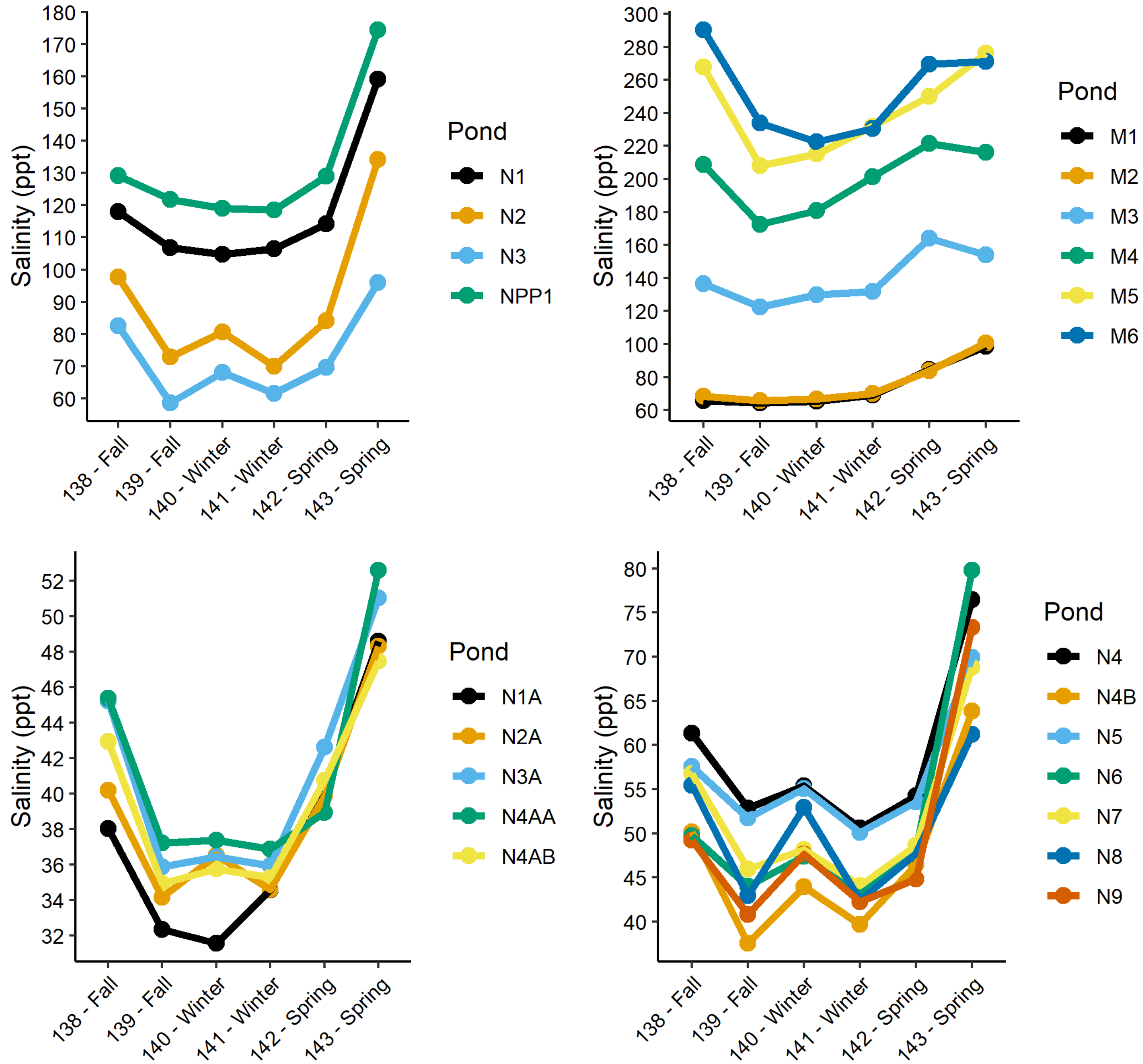

Figure 31. Average Salinity (ppt) at the Coyote Hills, Dumbarton, and Mowry pond complexes, South San Francisco Bay, California; September 2021 – May 2022. Scale differs between graphs.

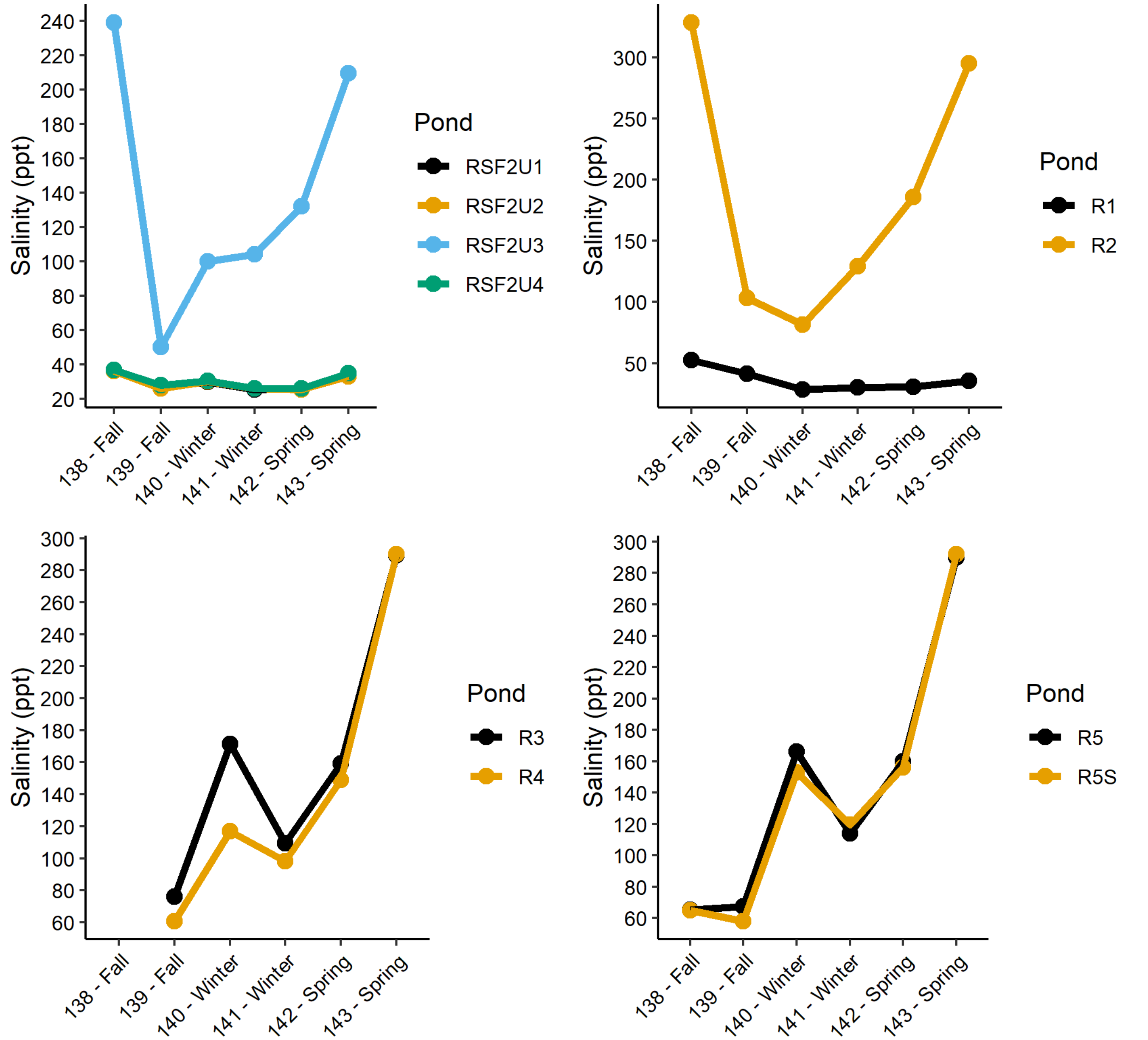

Figure 32. Average Salinity (ppt) at the Ravenswood pond complex, South San Francisco Bay, California; September 2021 – May 2022. Scale differs between graphs.

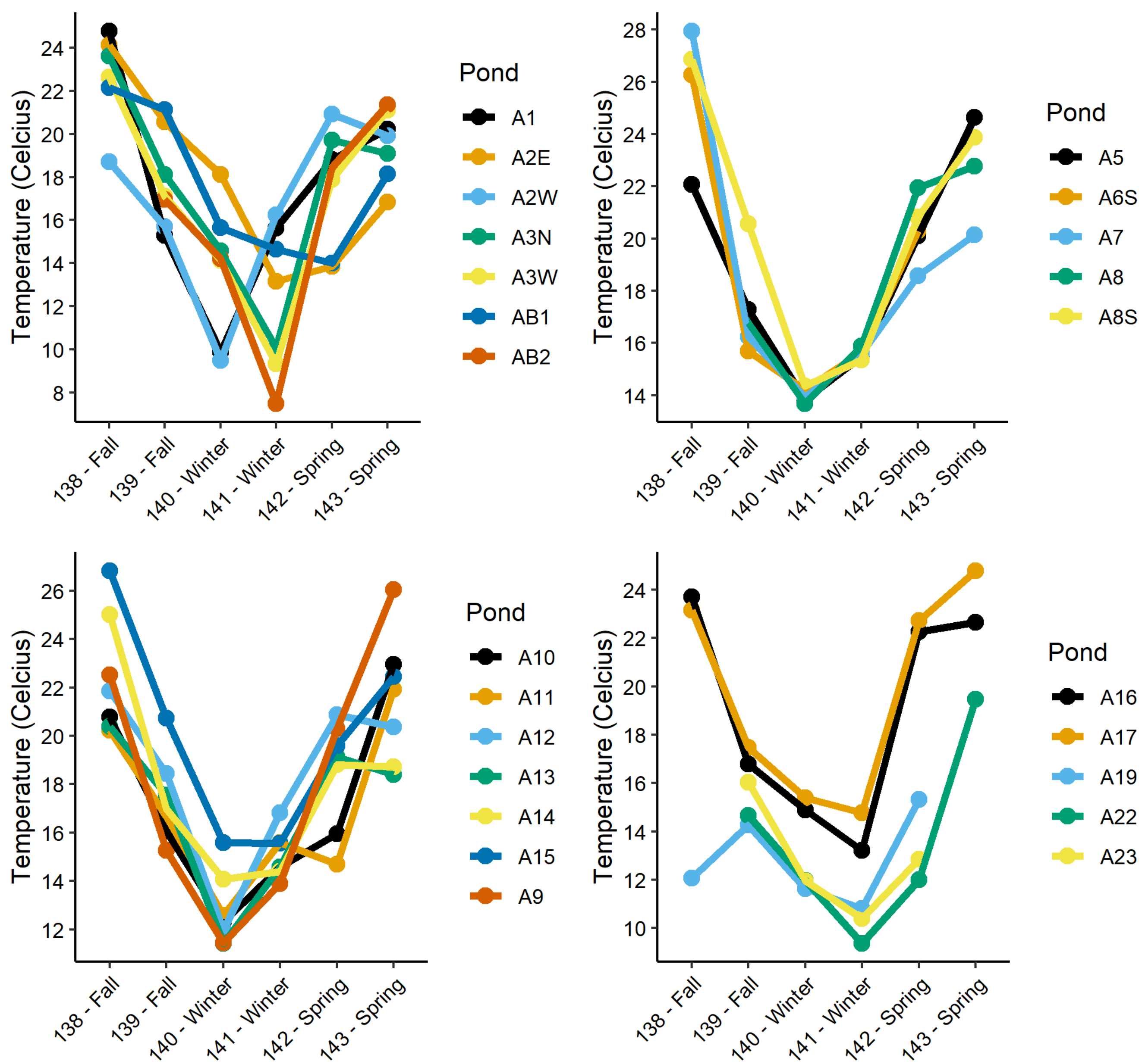

Figure 33. Average Temperature (Celcius) at the Alviso pond complex, South San Francisco Bay, California; September 2021 – May 2022. Scale differs between graphs.

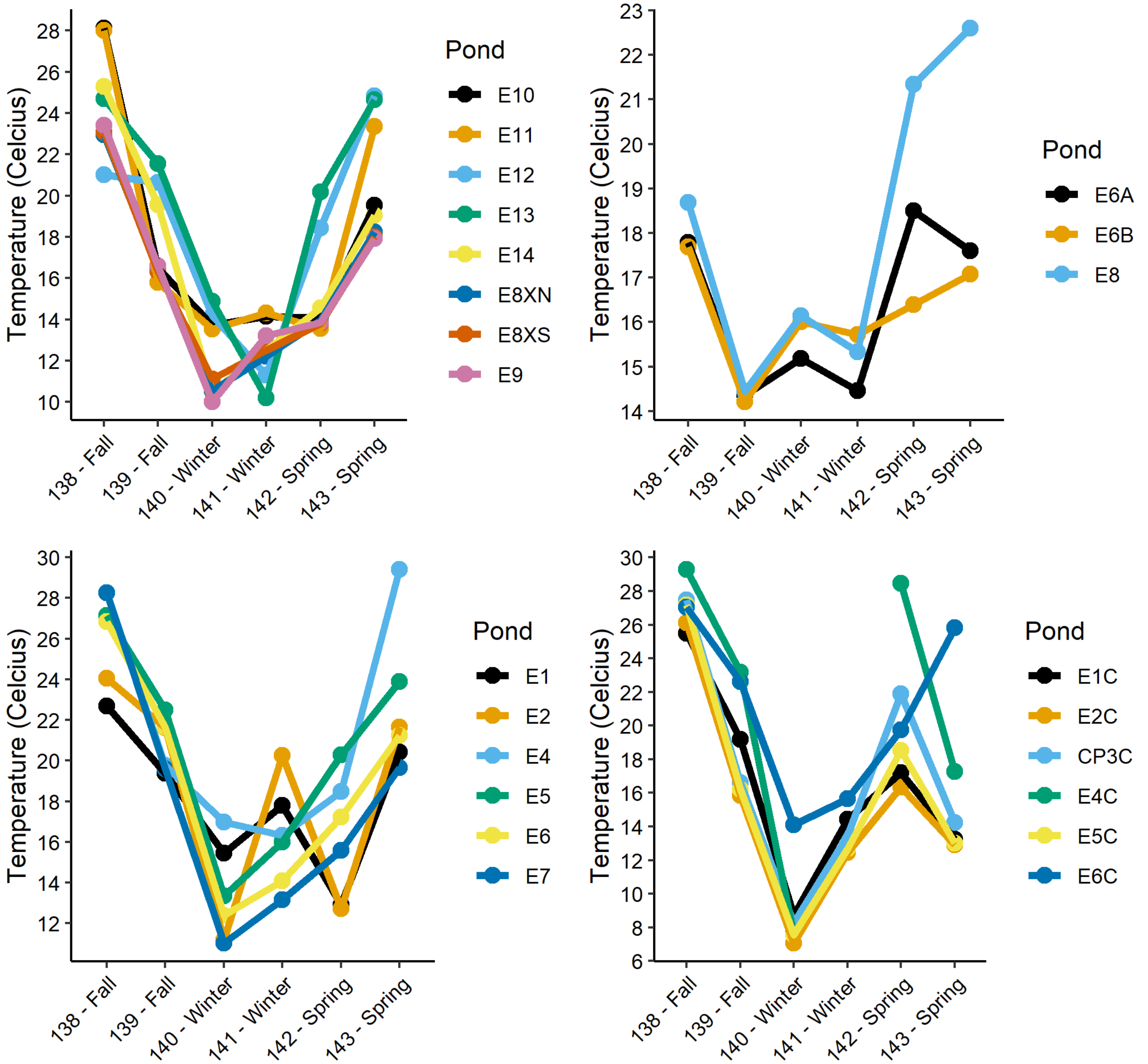

Figure 34. Average Temperature (Celcius) at the Eden Landing pond complex, South San Francisco Bay, California; September 2021 – May 2022. Scale differs between graphs.

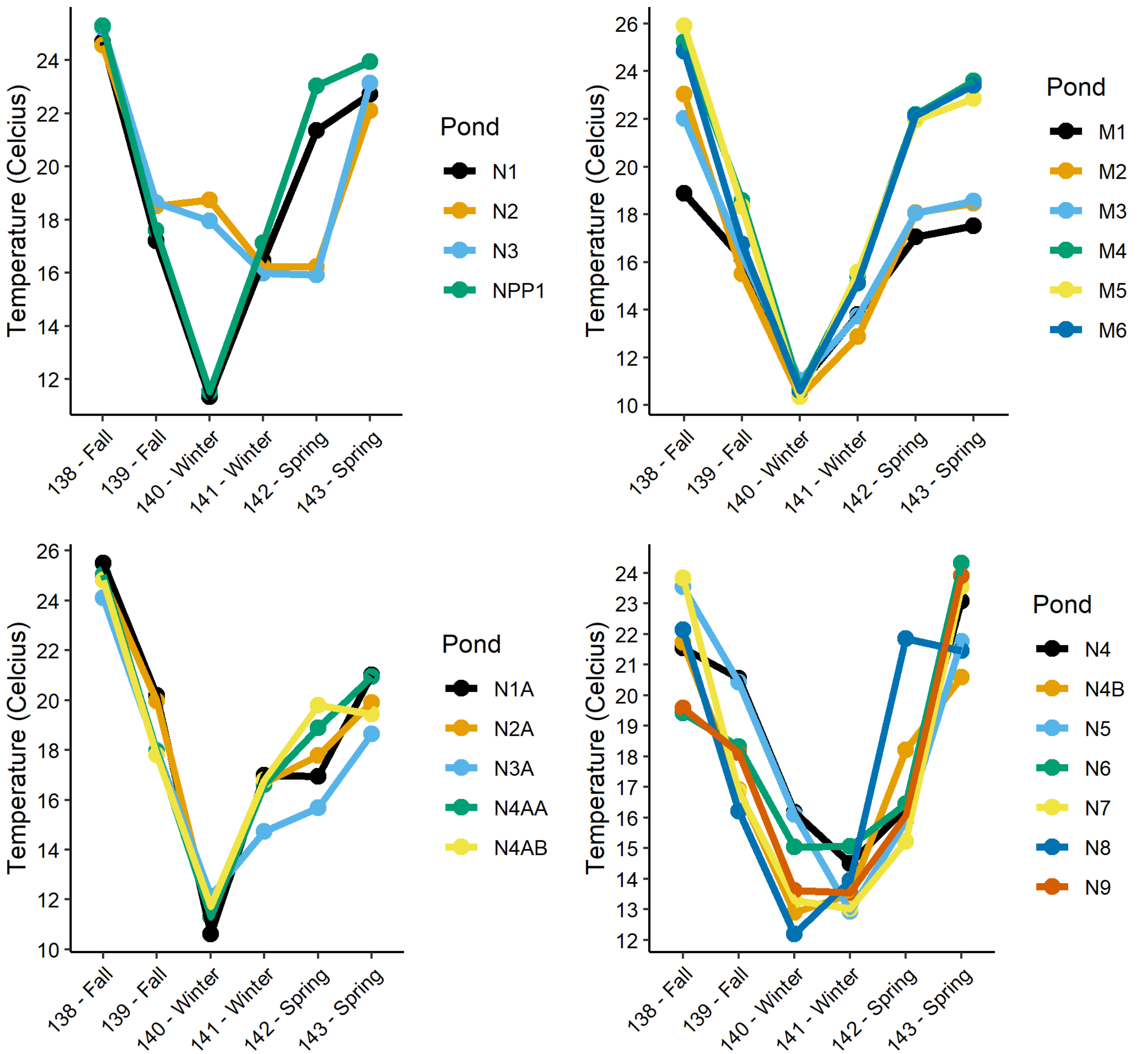

Figure 35. Average Temperature (Celcius) at the Coyote Hills, Dumbarton, and Mowry pond complexes, South San Francisco Bay, California; September 2021 – May 2022. Scale differs between graphs.

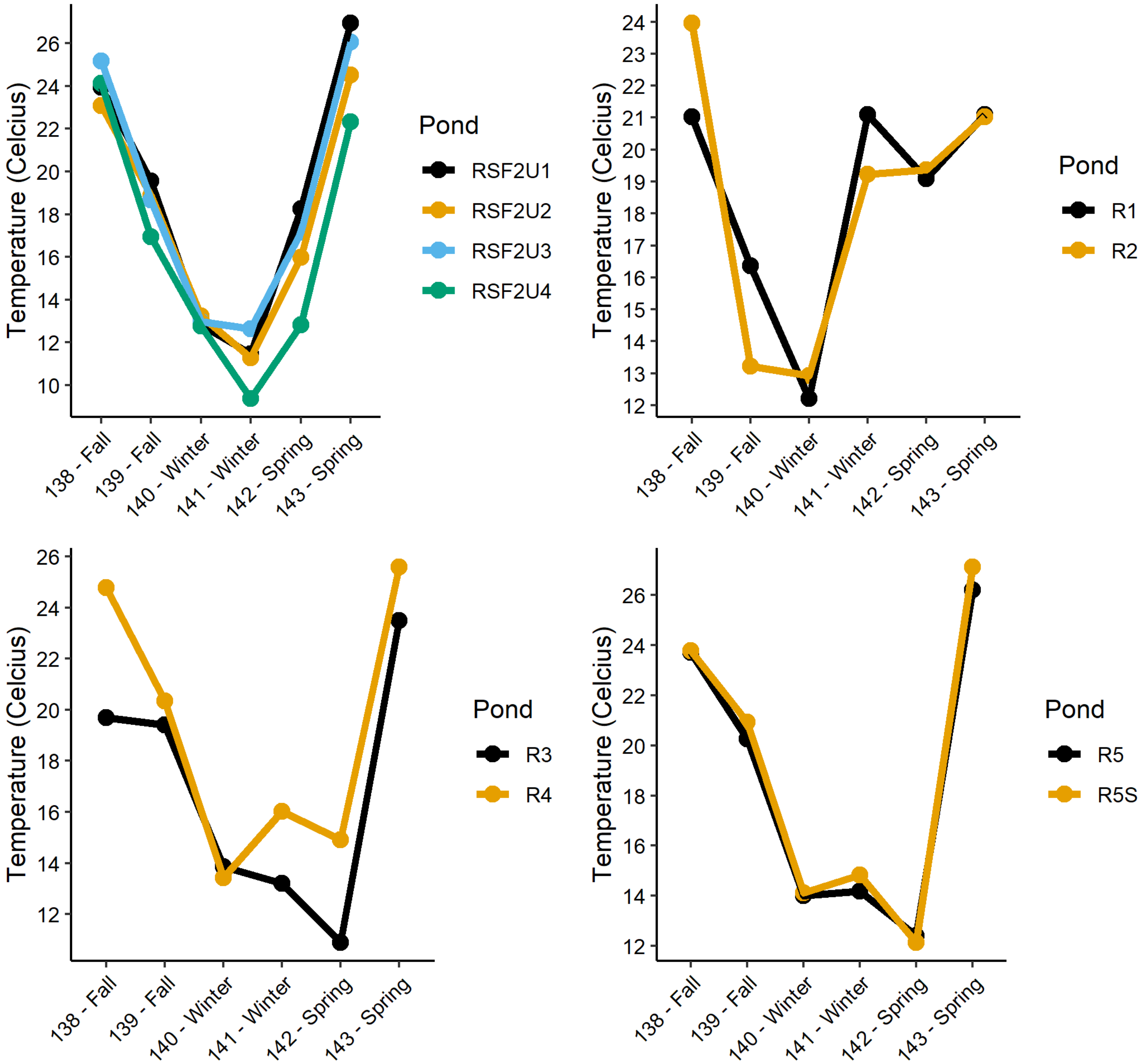

Figure 36. Average Temperature (Celcius) at the Ravenswood pond complex, South San Francisco Bay, California; September 2021 – May 2022. Scale differs between graphs.

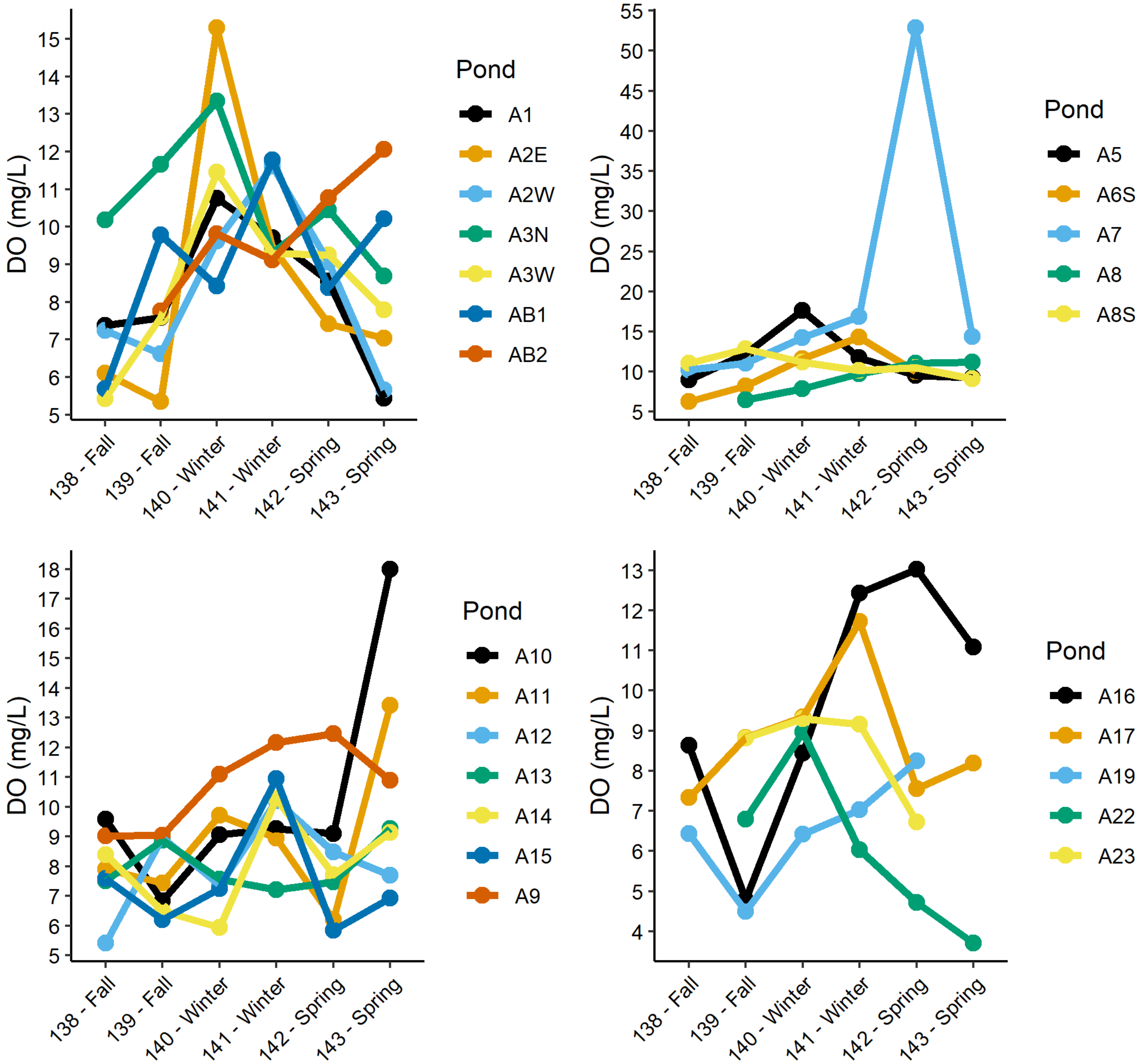

Figure 37. Average DO (mg/L) at the Alviso pond complex, South San Francisco Bay, California; September 2021 – May 2022. Scale differs between graphs.

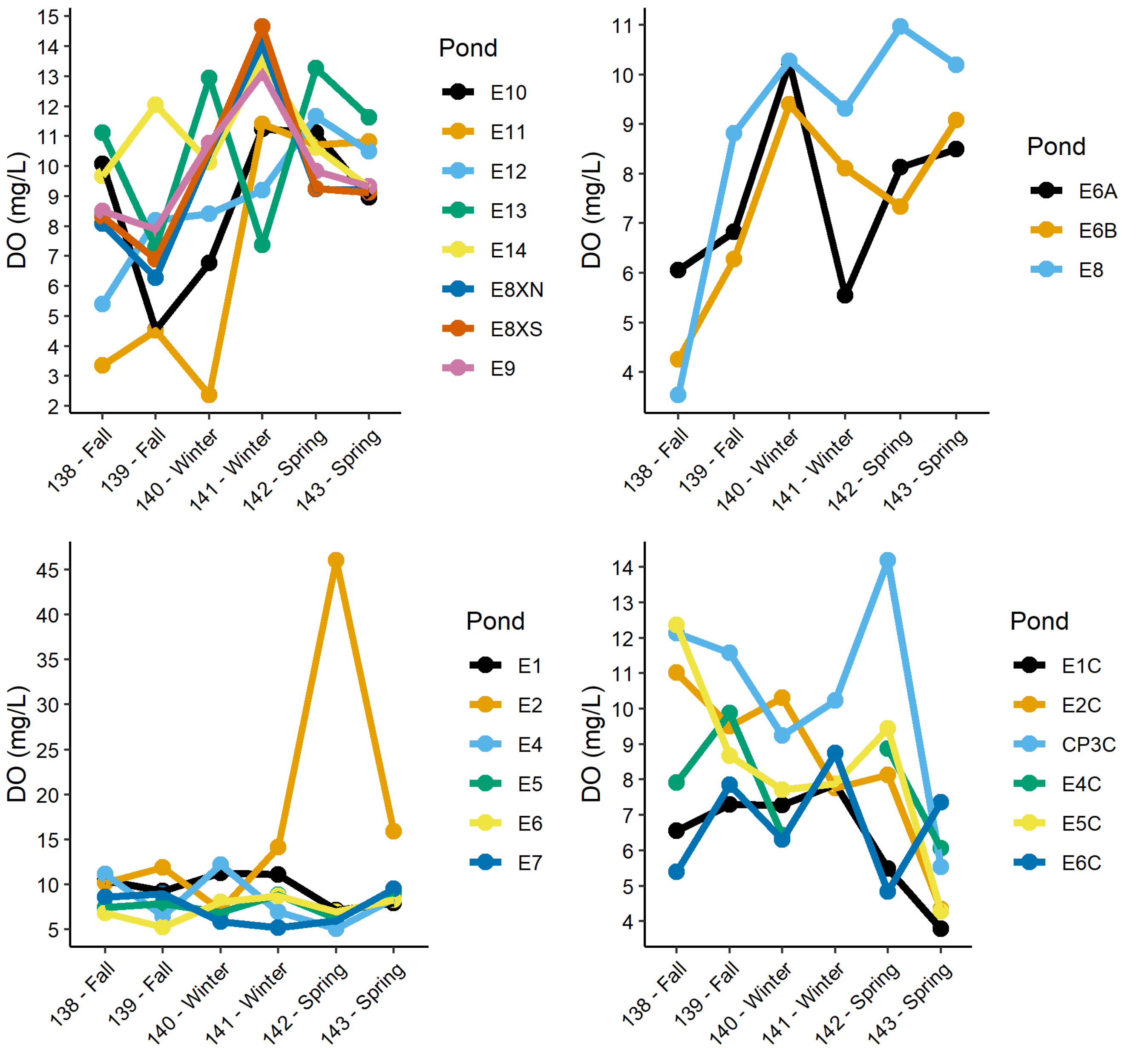

Figure 38. Average DO (mg/L) at the Eden Landing pond complex, South San Francisco Bay, California; September 2021 – May 2022. Scale differs between graphs.

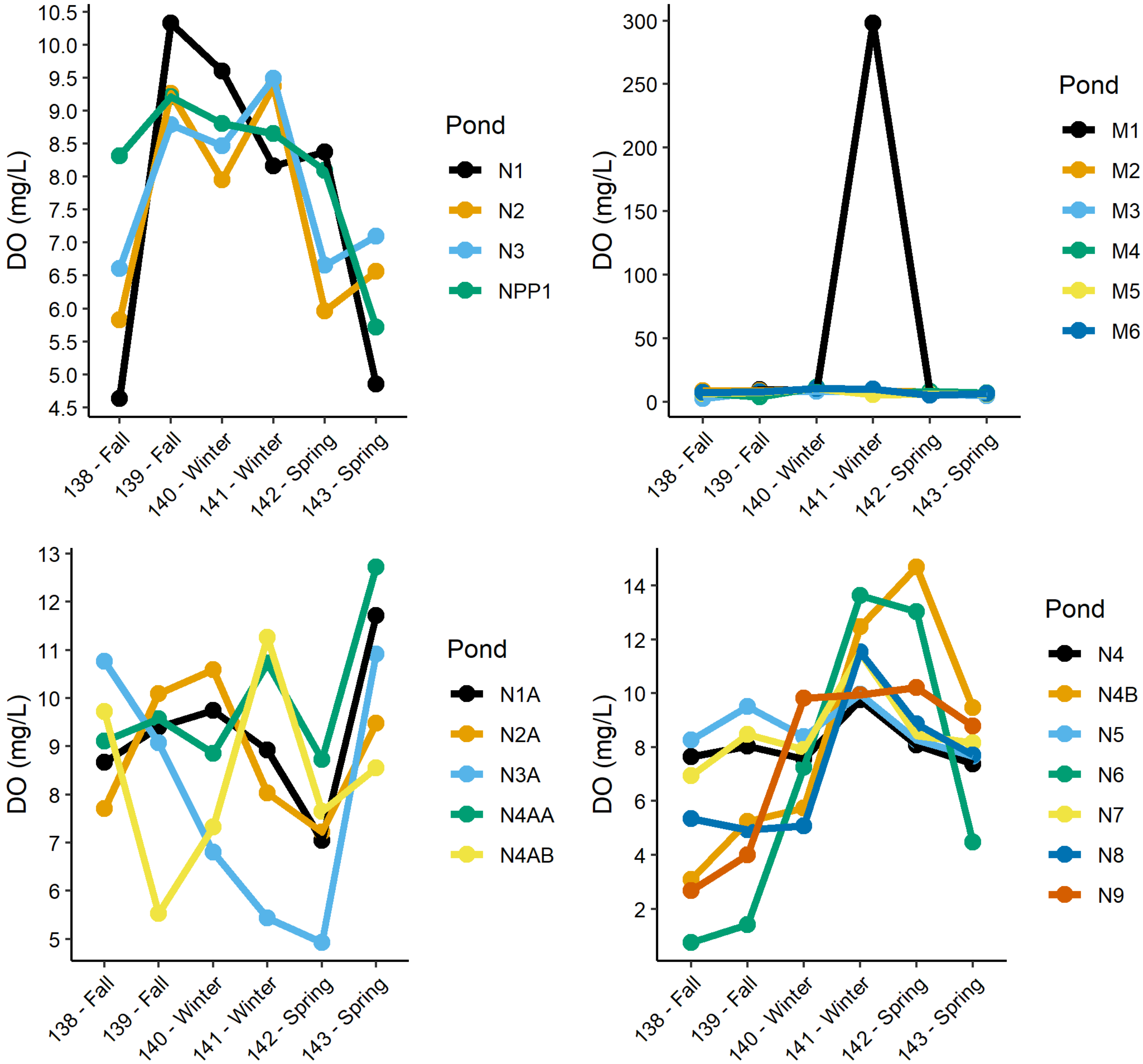

Figure 39. Average DO (mg/L) at the Coyote Hills, Dumbarton, and Mowry pond complexes, South San Francisco Bay, California; September 2021 – May 2022. Scale differs between graphs.

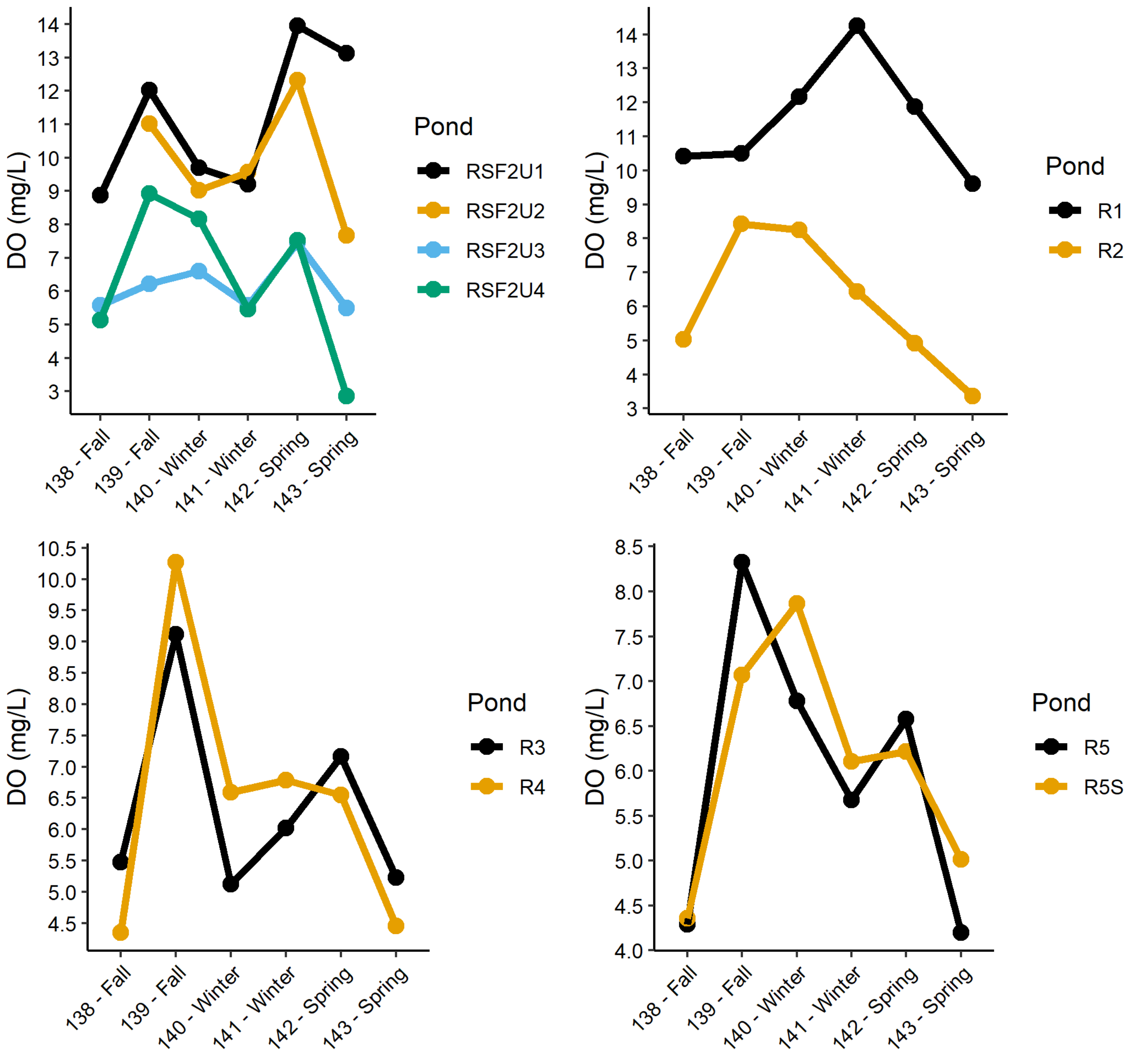

Figure 40. Average DO (mg/L) at the Ravenswood pond complex, South San Francisco Bay, California; September 2021 – May 2022. Scale differs between graphs.

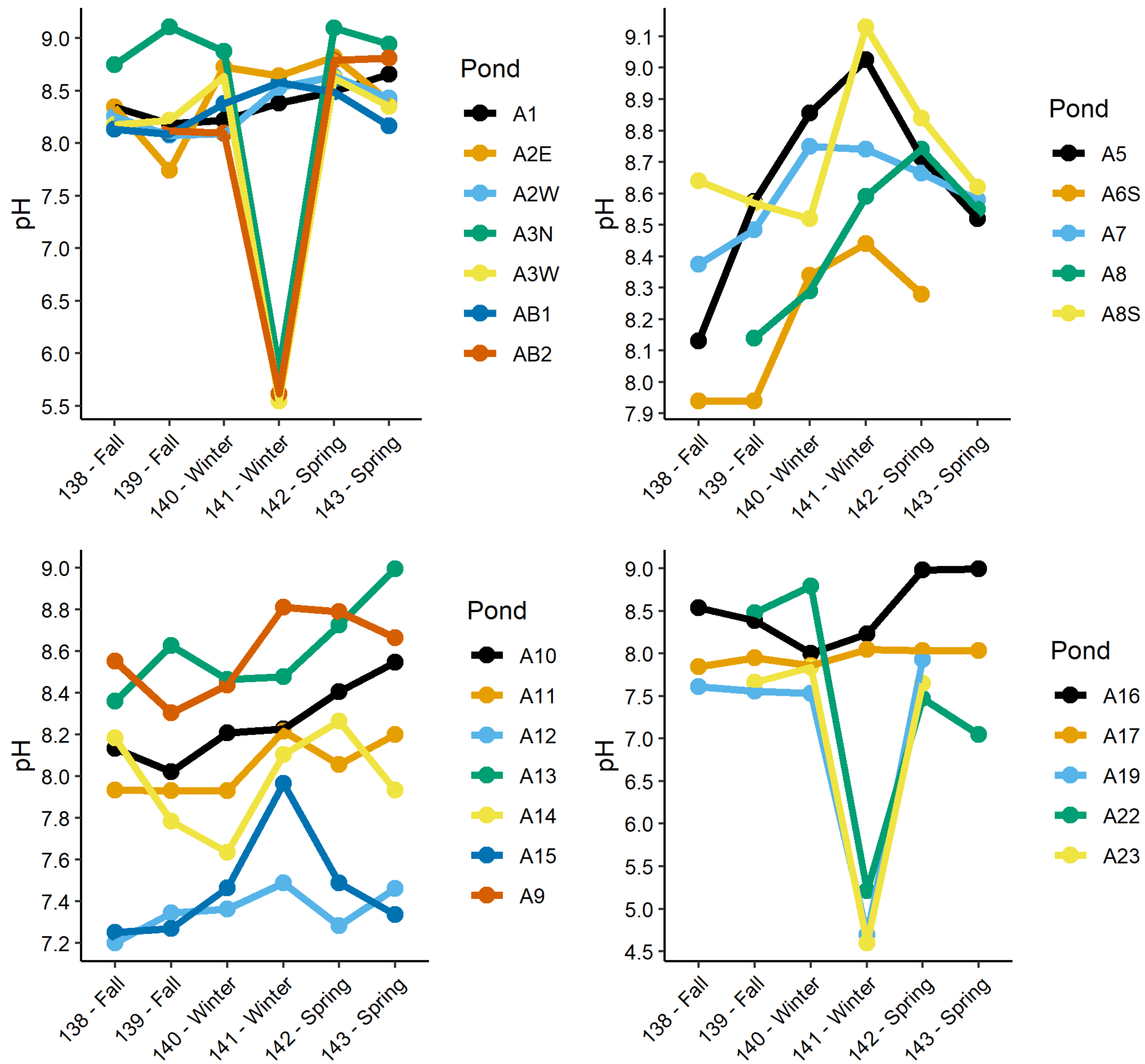

Figure 41. Average pH at the Alviso pond complex, South San Francisco Bay, California; September 2021 – May 2022. Scale differs between graphs.

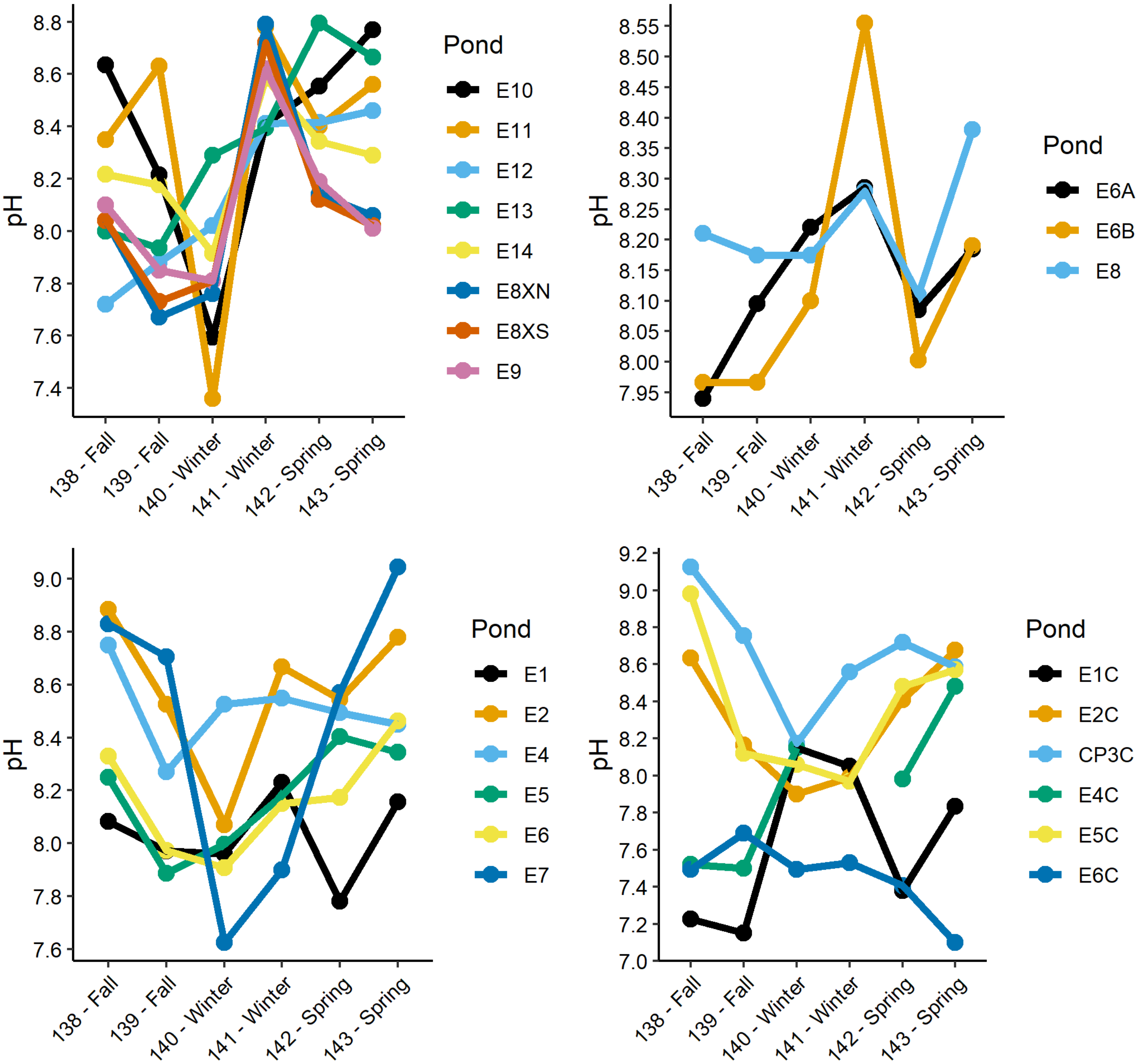

Figure 42. Average pH at the Eden Landing pond complex, South San Francisco Bay, California; September 2021 – May 2022. Scale differs between graphs.

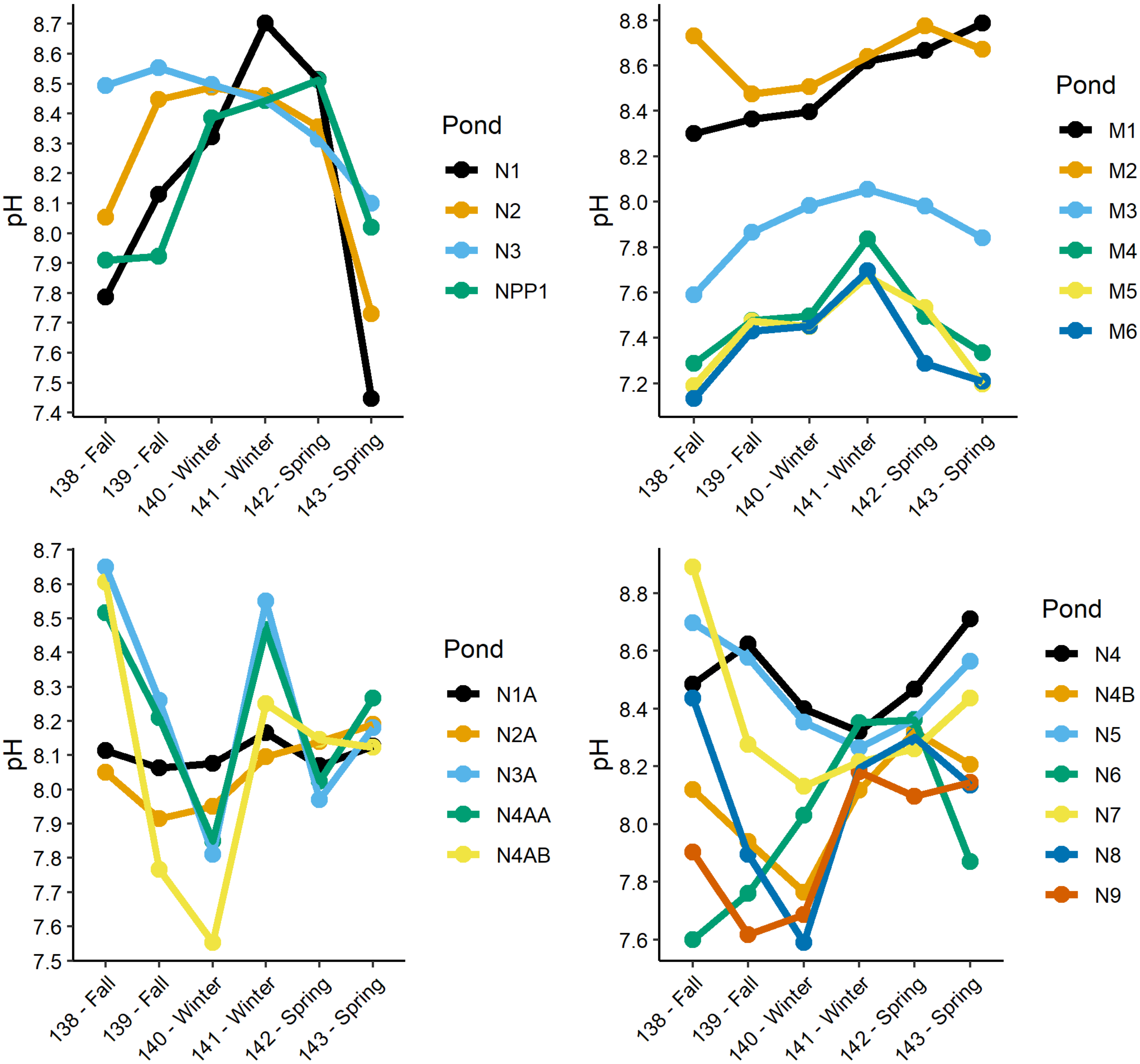

Figure 43. Average pH at the Coyote Hills, Dumbarton, and Mowry pond complexes, South San Francisco Bay, California; September 2021 – May 2022. Scale differs between graphs.

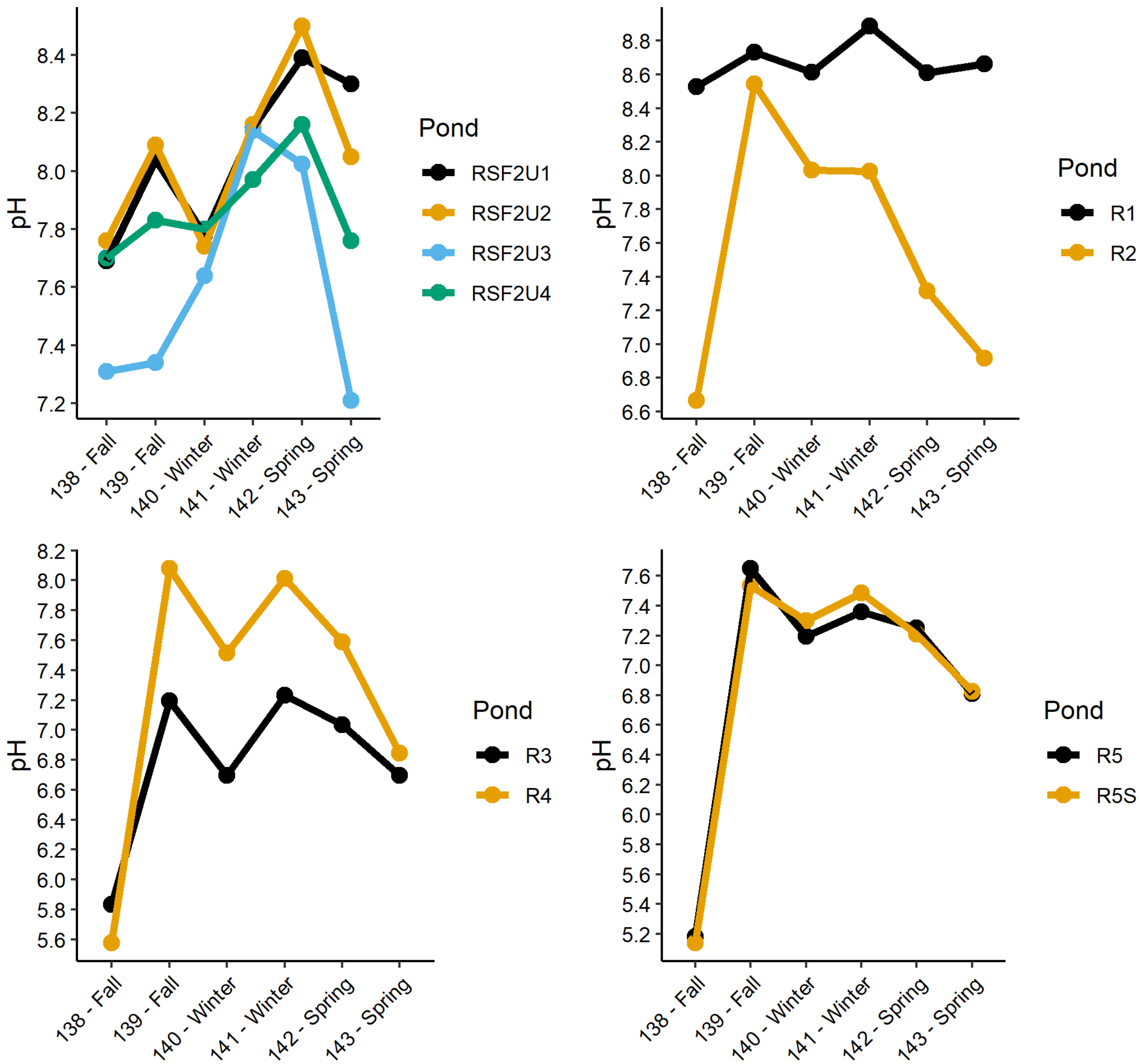

Figure 44. Average pH at the Ravenswood pond complex, South San Francisco Bay, California; September 2021 – May 2022. Scale differs between graphs.

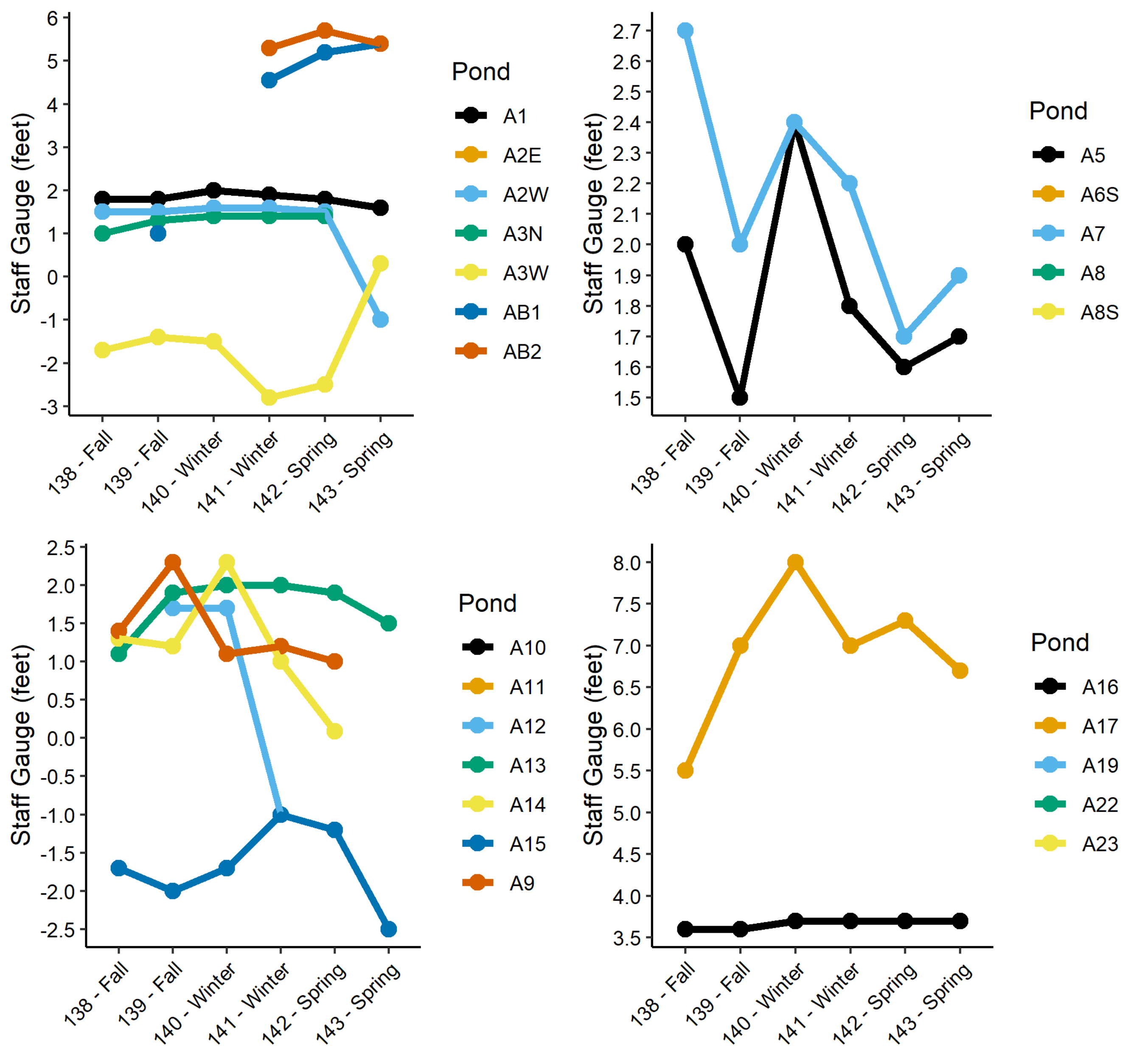

Figure 45. Average Staff Gauge (feet) at the Alviso pond complex, South San Francisco Bay, California; September 2021 – May 2022. Scale differs between graphs.

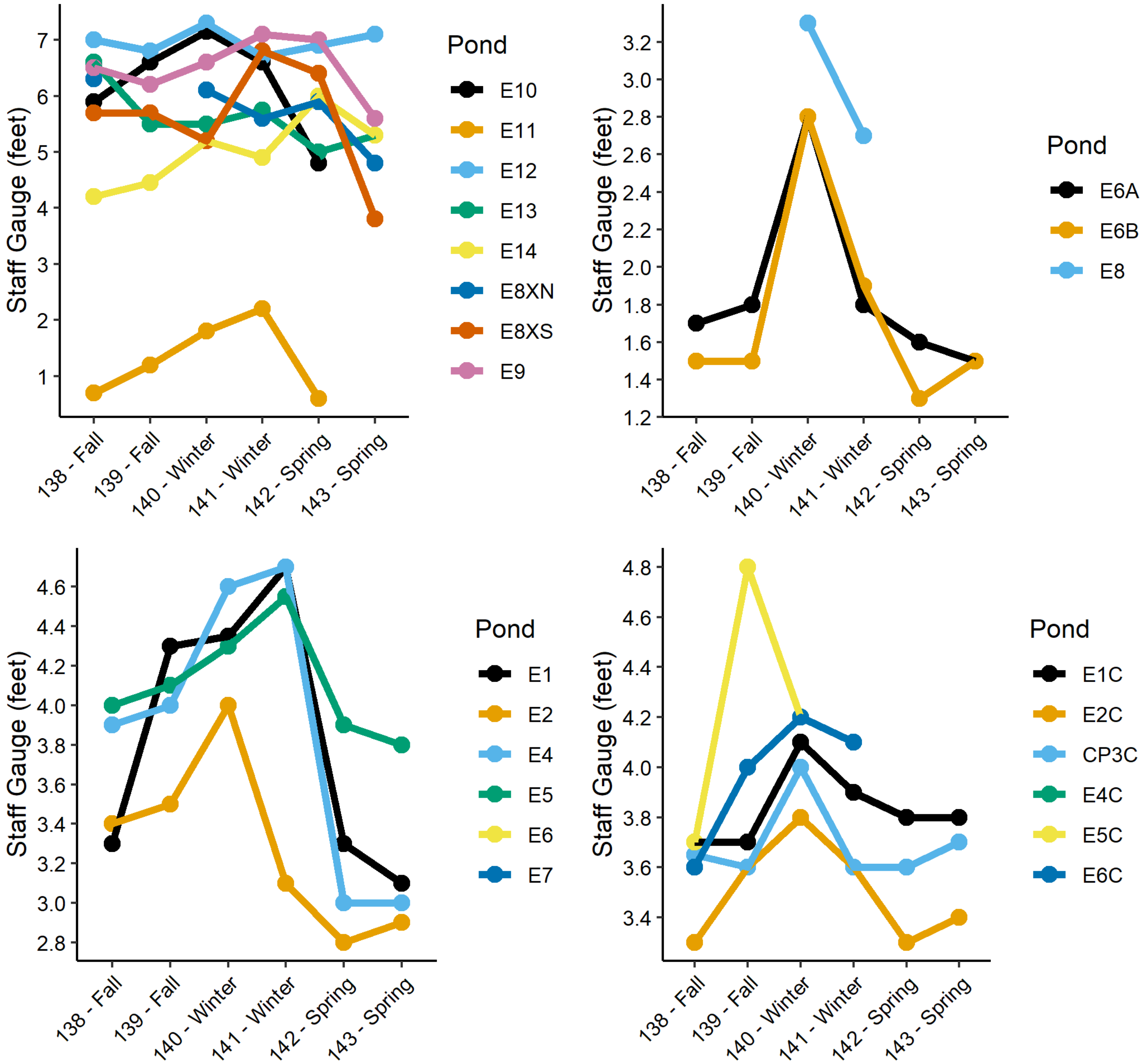

Figure 46. Average Staff Gauge (feet) at the Eden Landing pond complex, South San Francisco Bay, California; September 2021 – May 2022. Scale differs between graphs.

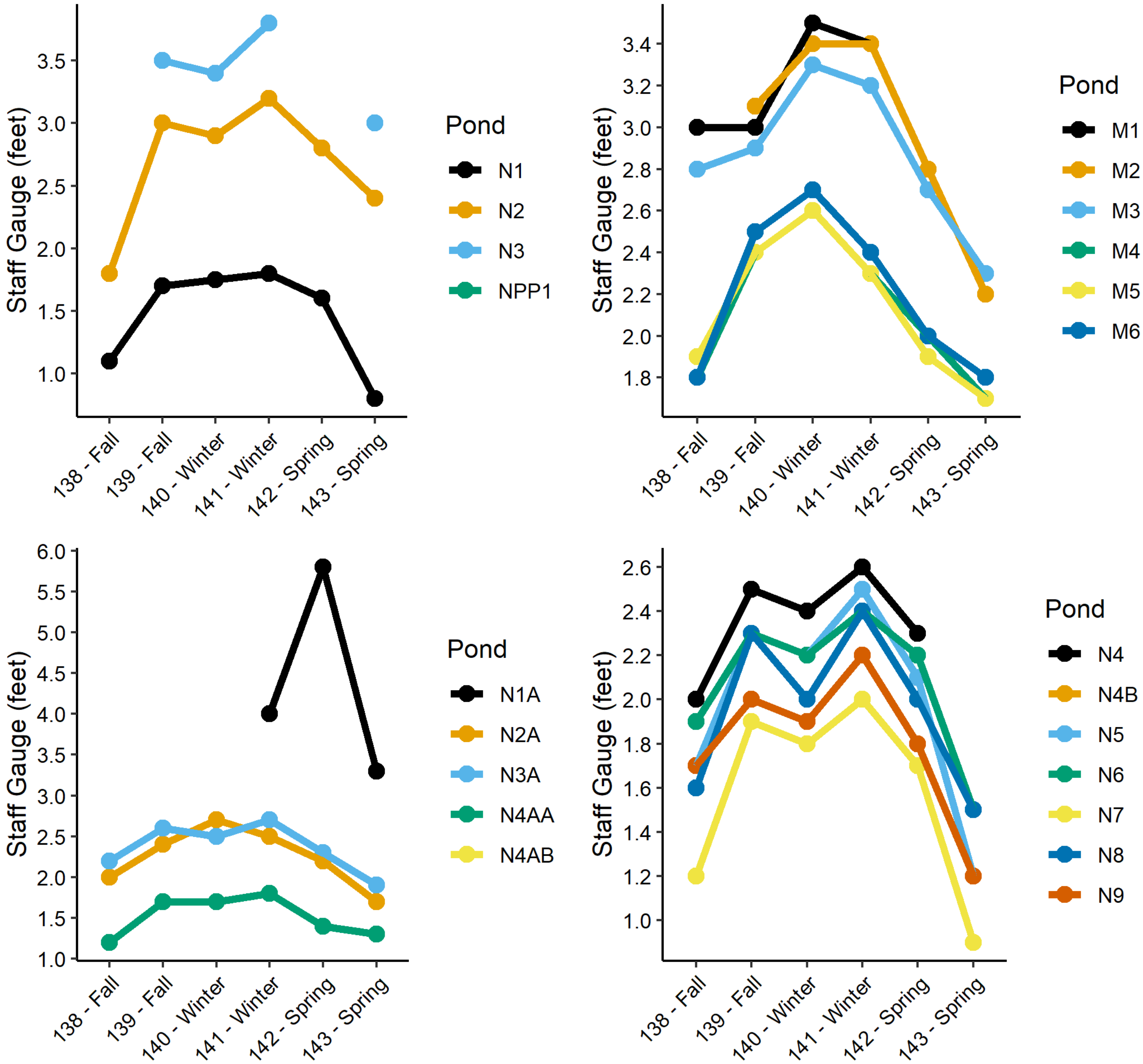

Figure 47. Average Staff Gauge (feet) at the Coyote Hills, Dumbarton, and Mowry pond complexes, South San Francisco Bay, California; September 2021 – May 2022. Scale differs between graphs.

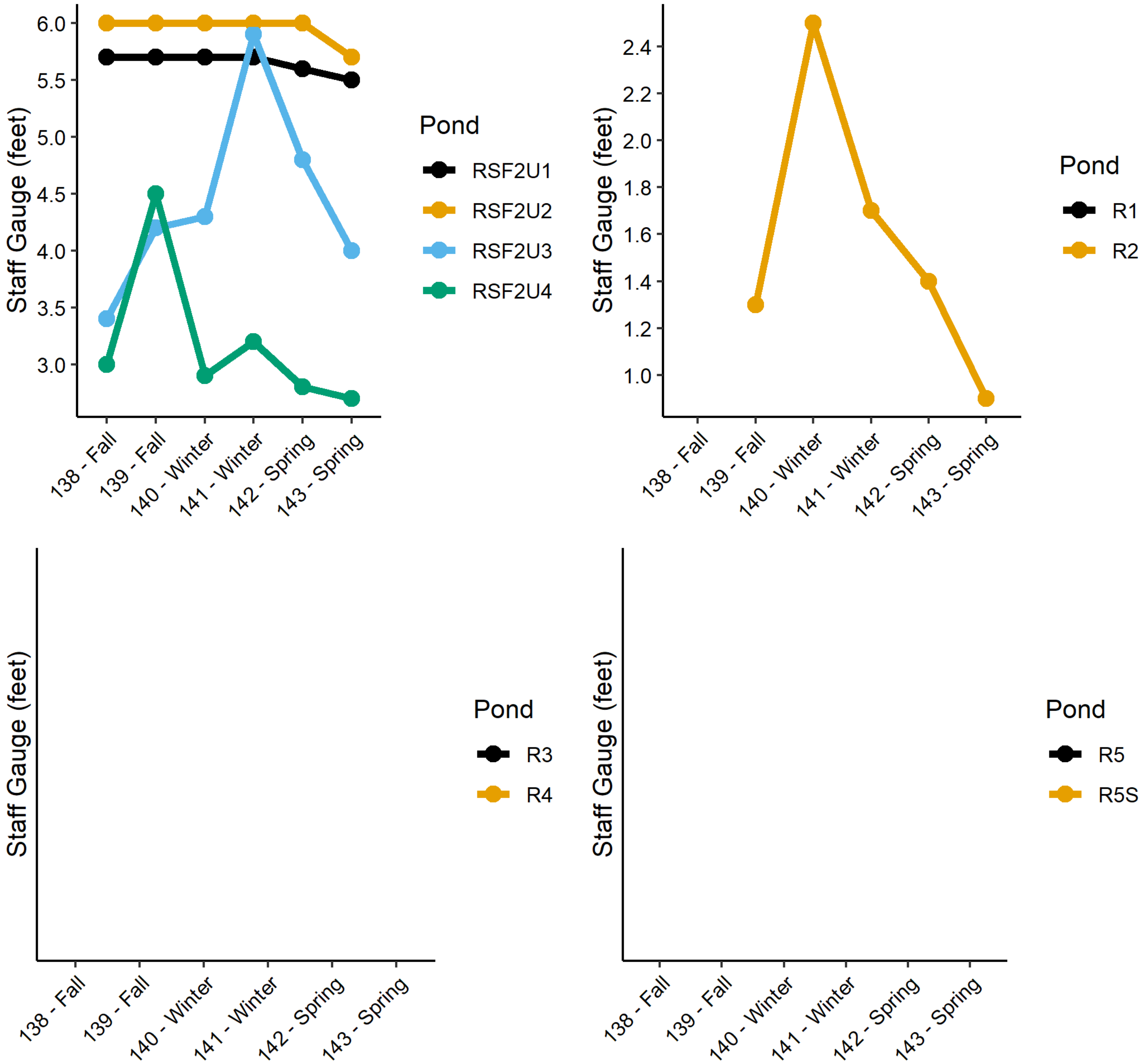

Figure 48. Average Staff Gauge (feet) at the Ravenswood pond complex, South San Francisco Bay, California; September 2021 – May 2022. Scale differs between graphs.

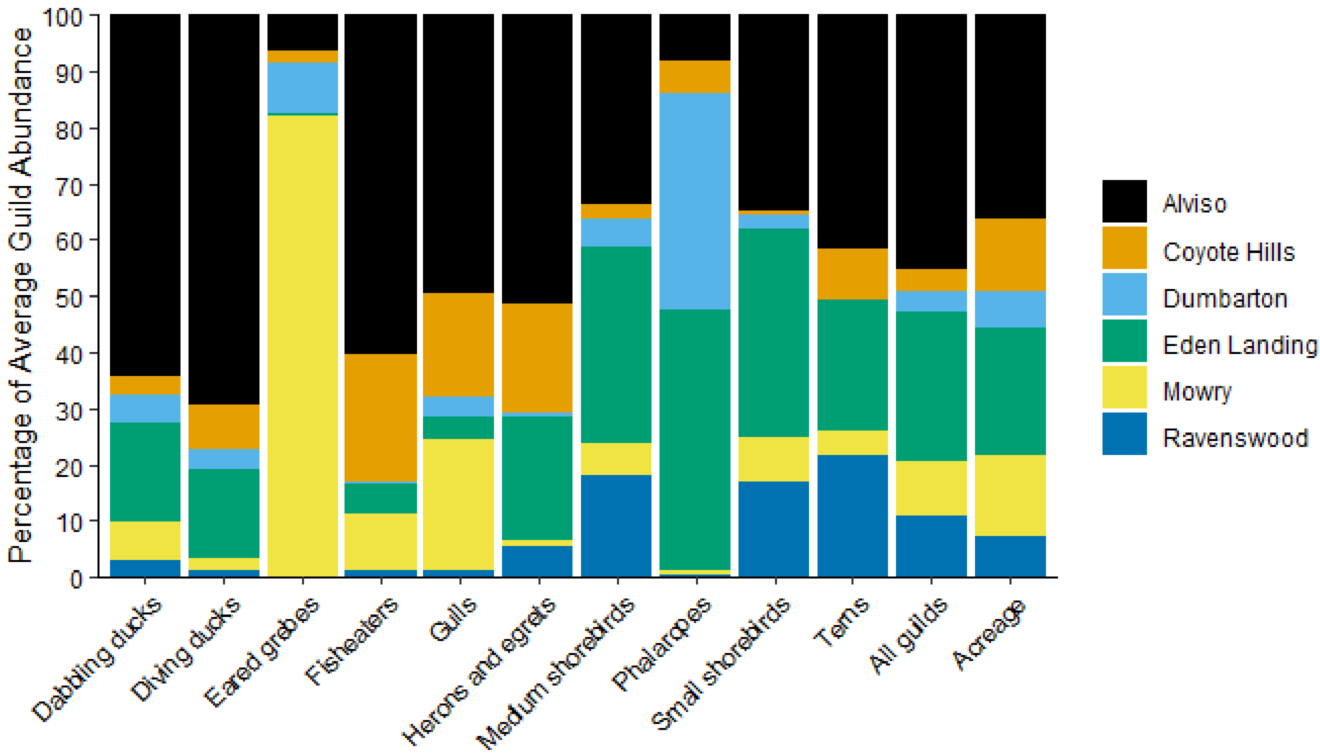

Figure 49. Percentage of average guild abundance by complex with relative acreage of the complexes, South San Francisco Bay, California; September 2021–May 2022. Reports prior to 2014 reported total abundance, rather than average abundance. Average abundance is more representative when sample sizes (number 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.

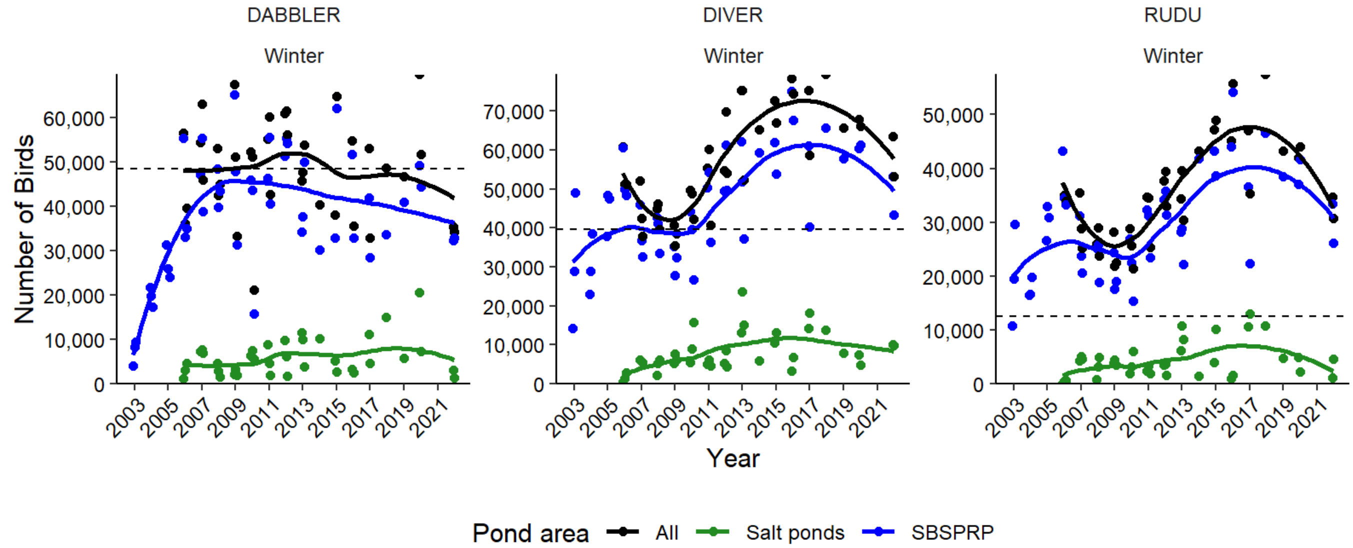

Figure 50. Counts of dabbling ducks, diving ducks, and Ruddy Ducks (RUDU) during peak seasons within the SBSPRP and salt production ponds. Lines represent LOESS curves and the dashed lines denote SBSPRP Targets or baseline values (average counts from 2005-2007).

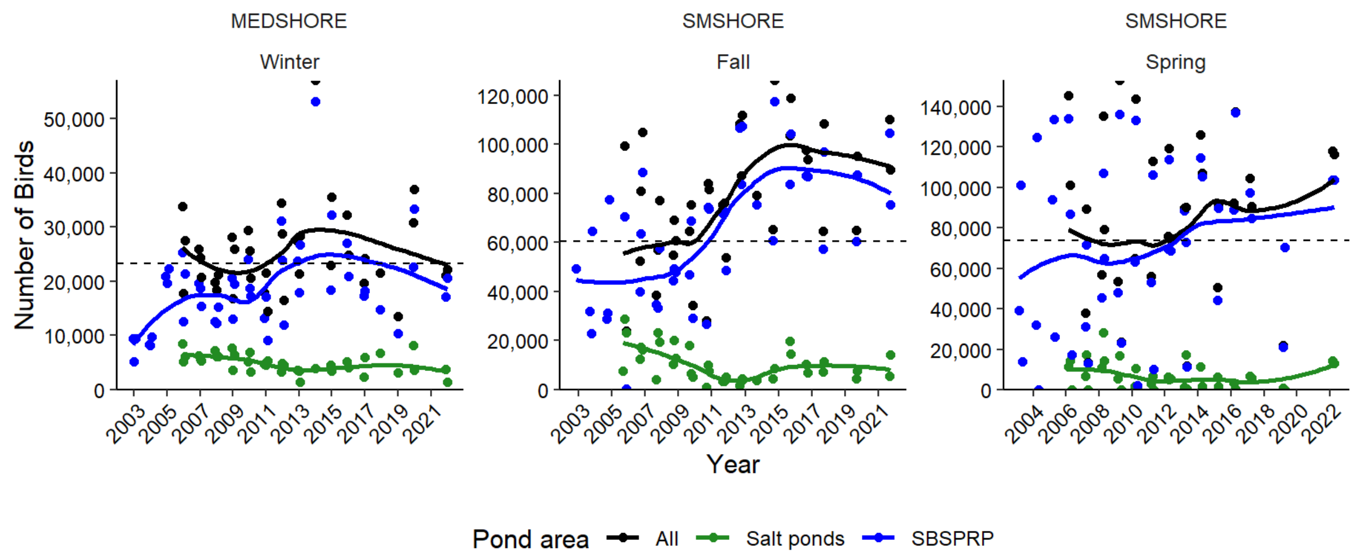

Figure 51. Counts of medium and small shorebirds during peak seasons within the SBSPRP and salt production ponds. Lines represent LOESS curves and the dashed lines denote SBSPRP targets or baseline values (average counts from 2005-2007).

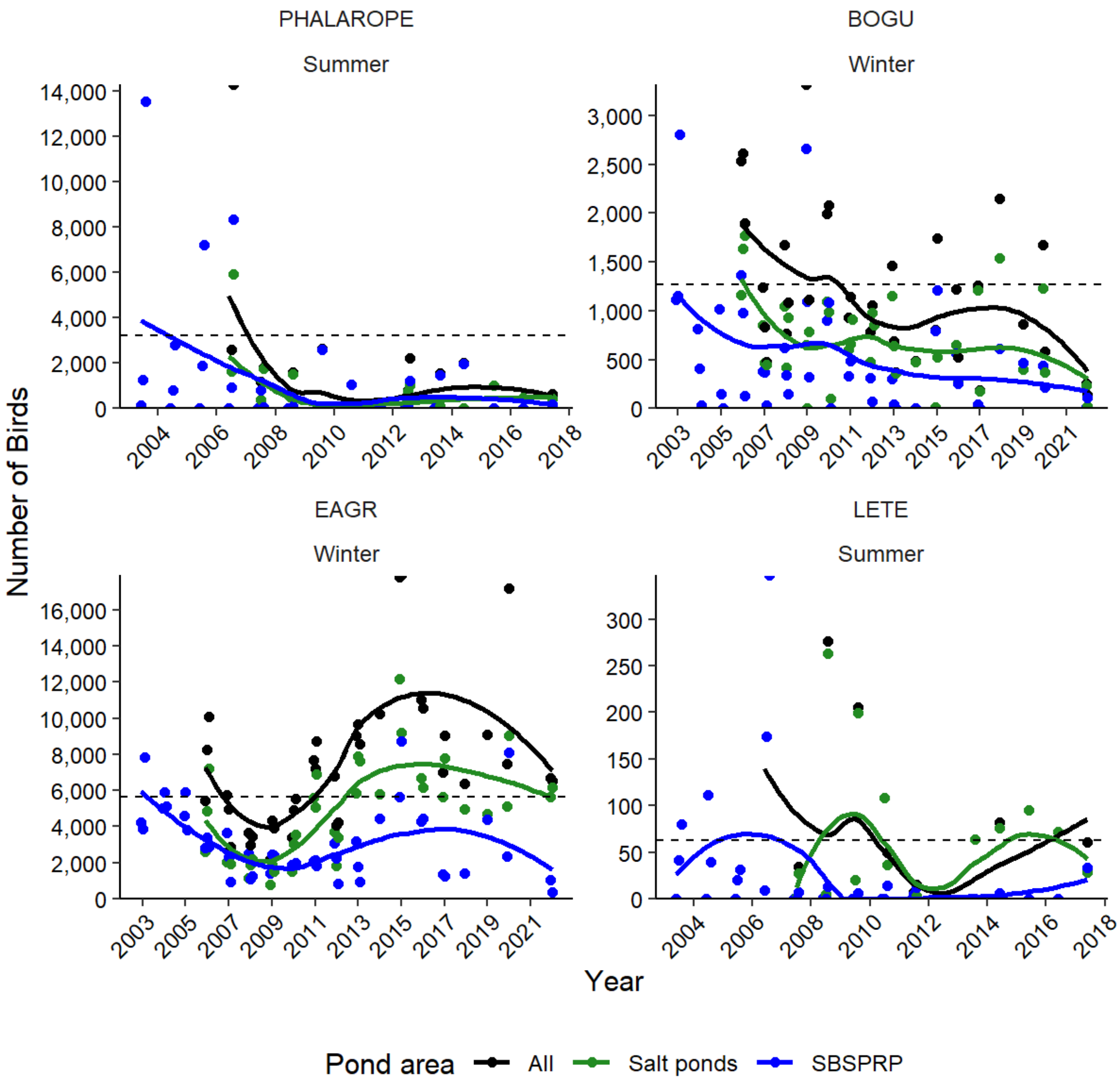

Figure 52. Counts of phalaropes (PHAL), Bonaparte's Gulls (BOGU), Eared Grebe (EAGR), and Least Terns (LETE) during peak seasons within the SBSPRP and salt production ponds. Lines represent LOESS curves and the dashed lines denote SBSPRP targets or baseline values (average counts from 2005-2007).

Appendix I

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

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		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
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
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
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

Table of targets, thresholds, and triggers for each waterbird species and guild of interest for monitoring in the South Bay Salt Pond Restoration Project area and South San Francisco Bay. Adapted from the SBSPRP Adaptive Management Plan: Adaptive Management Summary Table (Appendix 3) and restoration targets set by USFWS as part of the Recovery Plan for Tidal Marsh Ecosystems of Northern and Central California (2013). Originally compiled in Tarjan & Heyse (2018).

Species/Guild	Season	Target SBSPRP	Threshold
RUDU	Winter	12602	-15%
DIVER	Winter	39645	-20%
SMSHORE	Fall	60623	-20%
SMSHORE	Spring	73728	-20%
EAGR	Winter	5640	-50%
PHALAROPE	Summer	3225	-50%
BOGU	Winter	1270	-50%
DABBLER	Winter		
MEDSHORE	Winter		
LETE	Summer	63	