South Bay Salt Pond Waterbird Surveys
September 2023 – May 2024

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Executive Summary

This report serves as an assessment of waterbird and water quality monitoring efforts by the San Francisco Bay Bird Observatory between September 2023 and May 2024 at six pond complexes in the South San Francisco Bay. The purpose of this ongoing study is to describe avian use of ponds within and around the South Bay Salt Pond Restoration Project (SBSPRP), which is restoring 15,000 acres of former salt evaporation ponds to a mix of tidal marsh and enhanced managed pond habitats. The Coyote Hills, Dumbarton, and Mowry salt ponds are owned by Don Edwards San Francisco Bay National Wildlife Refuge and managed for salt production by Cargill Salt. Alviso and Ravenswood complexes are owned and managed by the U.S. Fish & Wildlife Service as part of the Don Edwards San Francisco Bay National Wildlife Refuge. Eden Landing Ecological Reserve (Eden Landing) ponds are owned and managed by California Department of Fish and Wildlife, with the exception of pond CP3C, which is owned by Cargill Salt. With the SBSPRP in its third decade, long-term monitoring has shown declines in some taxa but evidence of cyclical trends in others, which may be driven by climatic factors or density-dependent regulation. It is important to assess if observed declines were driven by SBSPRP actions or other factors. As the SBSPRP proceeds, understanding waterbirds habitat use and associations, and incorporating features essential to pond-dependent species into restoration plans, will be important to maintaining waterbirds in the South Bay and recovering populations that have experienced long-term declines.

From September 2023 – May 2024, 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 pond complexes. To understand waterbird use of ponds, we assessed taxa based on either foraging guild (e.g., dabbling ducks, small shorebirds) or specific species of special concern (Bonaparte's Gulls and Ruddy Ducks). We recorded 782,826 waterbird observations of 86 species (all sites combined). Overall, this was an unusually severe decrease of 463,246 compared to last year. Of the 12 focal waterbird taxa we assessed, counts had increased for 3 (Bonaparte's Gulls, herons and egrets, and phalaropes) and decreased for the remaining 9 (dabbling ducks, diving ducks, Eared Grebes, fisheaters, gulls, medium shorebirds, Ruddy Ducks, small shorebirds, and terns). The Alviso and Eden Landing pond complexes supported the greatest species diversity and Alviso had the highest abundances of all complexes.

For eight key guilds and species identified by managers, we modeled long-term trends in abundance within their target season to assess changes in waterbird numbers relative to baseline counts from before marsh restoration. Current counts were compared to management trigger targets. While abundance of 5 out of 9 currently surveyed target species/guilds (counting small shorebirds in both fall and spring migration) have increased in SBSPRP ponds since prior to restoration activities in 2005–2007, all 9 are currently declining. Furthermore, 7 out of these are declining more in the SBSPRP than in the Cargill-managed ponds (we did not assess comparison for phalaropes). Bonaparte's Gulls, dabbling ducks, medium shorebirds, and phalaropes are currently below the 2005–2007 baseline. As a result of low abundance over the past three survey years, management triggers are currently passed for 5 taxa: Bonaparte's Gulls, dabbling ducks, medium shorebirds, phalaropes and small shorebirds. Of the remaining 4 taxa which have not had management triggers set, only terns are currently above their baseline values, while fisheaters, herons and egrets, and gulls were all below their baselines (though for gulls, this may be a sign of the effectiveness of California Gull abatement strategies in South Bay).

To understand the drivers of observed changes we developed and applied a model relating changes in seasonal abundance of these eight waterbird species/guild abundance to changes in habitat conditions, annual weather, and static site characteristics. The proportion of variance explained was low, but results indicated that changes in pond conditions, not weather, were largely responsible for observed declines in 2024. Probable impacts of management actions may be identifiable by cross-referencing observed changes, shifts in pond conditions, and knowledge of recent management actions.

Introduction

Since 2002, the U.S. Fish and Wildlife Service (USFWS) and California Department of Fish and Wildlife (CDFW, formerly California Department of Fish and Game) have been restoring 15,100 acres of former salt evaporator ponds in the South San Francisco Bay. The South Bay Salt Pond Restoration Project (SBSPRP) is restoring the area to a mix of tidal and enhanced pond habitats managed for wildlife. Additional Project goals include enhancing flood protection and improving public access to these wetland areas.

These ponds were previously managed by Cargill Salt for commercial salt production, and have been present in the San Francisco Bay for over 150 years (Ver Planck 1958). Both current and former salt ponds have significant wildlife value (Anderson 1970, Accurso 1992, Takekawa et al. 2001, Warnock et al. 2002). As a part of the Pacific Flyway, the San Francisco Bay is a key habitat for migratory and wintering waterbirds, supporting more than a million birds throughout the year (Page et al. 1999, Warnock et al. 2002). The ponds may have become disproportionately important foraging and roosting areas for waterbirds due to the loss of wetlands elsewhere during European settlement, including the draining of over 90% of the wetlands in the Central Valley that form the core of the California's portion of the Pacific Flyway (Dahl 1990). Recognizing the value of the ponds, the SBSPRP plans to retain some of these areas as enhanced pond habitats for wildlife, while restoring most to their historical state as tidal marsh.

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 ponds managed for wildlife. After two decades of management changes and restoration, analyses of long-term population trends have shown some species and guilds have increased within the SBSPRP footprint, highlighting benefits of management changes, but others have declined (Van Schmidt & Parsons 2024). Some specialist guilds/species may be at-risk of declining as salt ponds altered into enhanced pond habitats and/or restored to tidal action experience changes in water quality characteristics (i.e., salinity, pH, dissolved oxygen, and temperature) that may affect invertebrate communities. Current and former salt ponds notably support many hypersaline specialist species, such as phalaropes, Eared Grebe, and Bonaparte's Gull, whose saline lake habitats elsewhere in the Great Basin are imperiled by climate change and water withdrawals (Carle et al. 2023, Herring et al. 2025).

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

This report summarizes the results of surveys conducted by San Francisco Bay Bird Observatory (SFBBO) in the South San Francisco Bay pond complexes from September 2023 to May 2024.

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 (Fig. 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.

The salinity and depth of all ponds varies from year to year due to restoration and pond enhancement activities, and the management practices and business needs of salt production. Though not directly the target of management, this results in changes in other water quality parameters—temperature, pH, dissolved oxygen, and specific conductivity—which may also affect invertebrate communities and waterbird abundance.

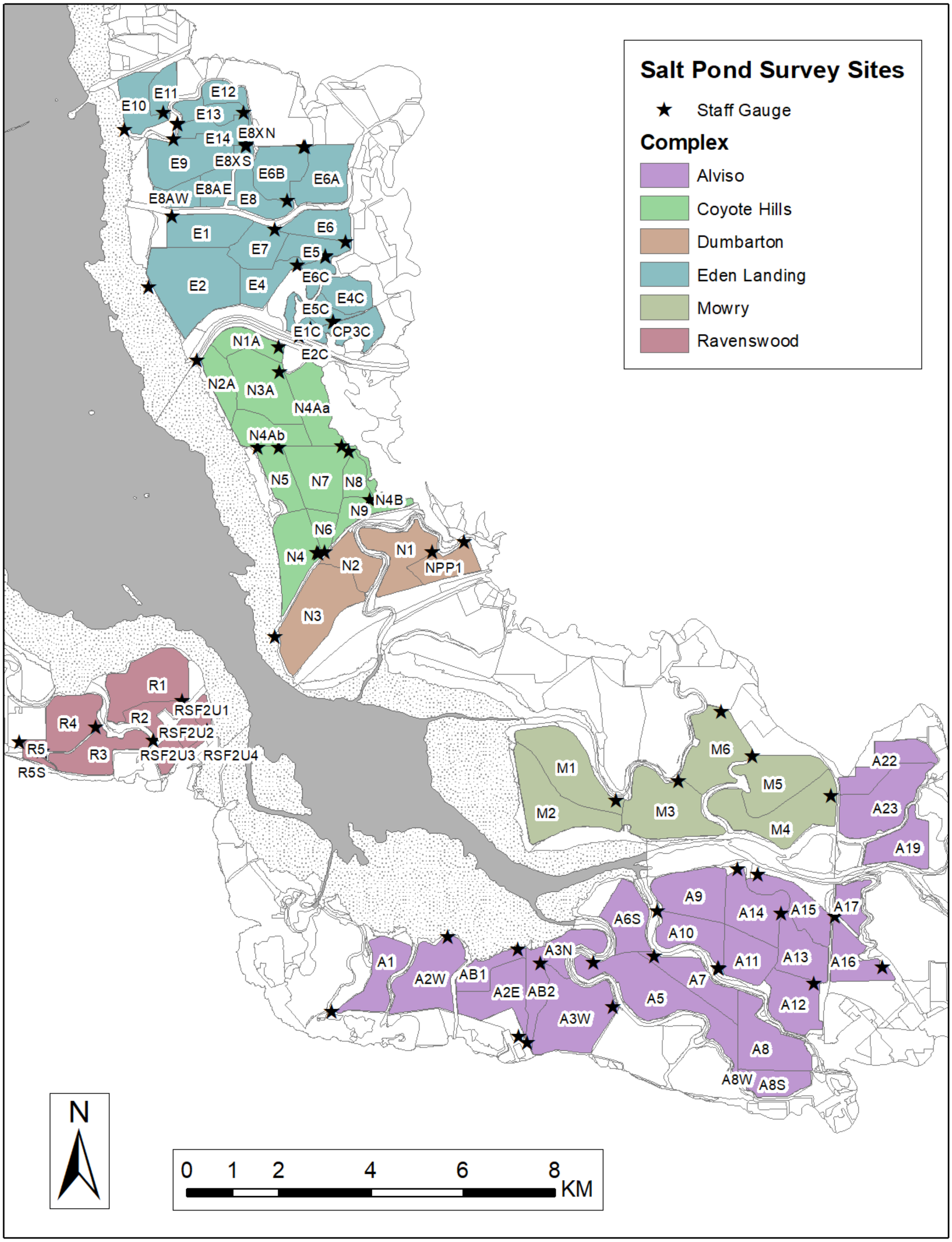

Figure 1. Map of the study area and all ponds surveyed by the San Francisco Bay Bird Observatory from September 2023 – May 2024 in South San Francisco Bay, California.

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
150	Fall	September 2023	2023-09-05	2023-10-13
151	Fall	October 2023	2023-10-16	2023-11-22
152	Winter	December 2023	2023-12-01	2024-01-12
153	Winter	January 2024	2024-01-17	2024-02-27
154	Spring	March 2024	2024-03-04	2024-04-11
155	Spring	April 2024	2024-04-15	2024-05-25

Waterbird Surveys

We conducted waterbird surveys at each of the 82 ponds in the Alviso, Coyote Hills, Dumbarton, Eden Landing, Mowry, and Ravenswood complexes (Table 1). 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). 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.

During each survey, we observed birds from the nearest drivable road or levee using spotting scopes and binoculars. 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). 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).

Water Quality Sampling

During each bird survey, we recorded water levels by reading the water level on staff gauges if present. See Appendix 8 for a list of all ponds and 2024 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 followed water quality monitoring methods outlined by Murphy et al. (2007). Water quality samples were collected from the surface of the water (depth of <0.5 m). The number of sampling points per pond varied based on the size, configuration, and accessibility of the pond. As of spring 2024, most of the 82 total ponds had three (32 ponds, 39%) or two (21 ponds, 26%) sampling points, but a few had one (14 ponds, 17%) or four (12 ponds, 15%). Three ponds (A8W, E8AE, E8AW; 3%), had no water quality points due to inaccessibility of the water surface (e.g., due to being restored to tidal marsh). Some sampling points could also temporarily not be reached due to low water levels within the pond during some surveys. Whenever possible, water quality data was collected on the day of the bird survey, but otherwise was collected as close to the date of the bird survey as possible. We recorded dissolved oxygen (mg/L), salinity (ppt), conductivity (mS), pH, temperature (°C), and barometric pressure (not used as a water quality measure) at 1-4 pre-determined sampling sites at each pond using a Hanna HI98494 Sonde (Hanna Instruments Inc, Woonsocket, RI). When salinities exceeded approximately 70 ppt (the maximum value registered by the Hanna HI98494 Sonde), we calculated salinity using a hydrometer (Ertco, West Paterson, NJ) to measure specific gravity in combination with a temperature reading from the water sample. We calibrated the LDO sensor before the start of each sampling day, and conductivity and pH sensors at the beginning of each week of sampling.

Historical Surveys

Prior to October 2013, two entities, the U.S. Geological Survey (USGS) and SFBBO, conducted monthly waterbird surveys and water quality sampling at South Bay ponds. Beginning in 2002, USGS monitored those ponds located within the SBSPRP footprint beg, while beginning in 2005, 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 2021). Beginning in September 2021, regular surveys were conducted twice in the fall, winter, and spring at all 82 ponds.

Prior to January 2019, 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. Starting in January 2019, birds were only assigned to sites and use of grids was discontinued. All data summarized in this report is at the pond level. Beginning in fall 2021, we surveyed pond A19 from the Newby Island Landfill, which substantially increased the area of this tidally restored pond that was visible to surveyors.

Data Summary

Data were analyzed and figures generated in R version 3.5.1 (R Development Core Team 2018). Data were loaded from Microsoft Access in R x86, but all subsequent processing was done in R x64.

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. 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.

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 2023 to May 2024. When calculating species richness we included waterbird species not in the focal guilds (i.e., geese, rallids, and flamingos).

Guilds

We categorized each species into a foraging guild based on foraging methods and prey requirements (see Appendix 1). 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. Geese, rallids, and flamingos were not analyzed. 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. 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. Generally, this was a four-season year from September through August 2005-2017 for years 2005-2016, and a three-season year from September to May from 2019-present. Due to a hiatus in surveys from January 2018 to December 2018, year 2017 included data from only from September 2017 to January 2018, and year 2018 only from January 2019 to May 2019. There was another hiatus in year 2020 due to COVID-19, where surveys only ran from December 2020 to February 2021. 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.

Abundance

We estimated "seasonal abundance" (fall, winter, or spring) as the mean number of sightings across the two survey rounds within each season, and used this as our primary measure of inter-annual change and habitat relationship modeling. 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. Therefore, when discussing the entire year we report only "total sightings" (rather than abundance) as the sum of all bird sightings for each species or guild encountered across all surveys from September 2023 to May 2024. We calculated both total sightings and seasonal abundance at both the pond and complex levels. When reporting total sightings and seasonal abundance of waterbirds as a group, we included species that were not in the focal guilds (i.e., geese, rallids, and flamingos).

To highlight ponds experiencing unusual declines as an early alert, or identify potential beneficial waterbird responses to conditions, we identified unusually high or low abundance of guilds in each pond during each of the three seasons. We listed ponds as having exceptionally low abundance when they were in the 5th percentile of all surveys across all years for a given guild in each season. We identified ponds as having exceptionally high abundance of a given guild when they had both (1) record high mean seasonal counts as compared to all counts in all years for that guild in any season (excluding summer, because these surveys are no longer conducted), and (2) an average seasonal abundance of ten or more (to prevent flagging "high abundance" from unusual observations of a handful of birds at a pond they are generally absent from).

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.

Long-term Trends

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

Therefore, we used non-parametric locally weighted smoothing (LOESS) regression (package *ggplot2*) and running three-year averages to assess long-term trends (De La Cruz et al. 2018, Tarjan 2021). Earlier reports had also explored linear trends (base package *stats*) and generalized additive models (GAMs), but found these less suitable (De La Cruz et al. 2018, Tarjan 2021). We estimated long-term 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). Trends were estimated for the entire study area, within the Cargill-managed salt ponds, within the SBSPRP-managed ponds that have so far been retained as managed wildlife ponds, and within the SBSPRP-managed ponds that have been tidally breached (ponds that were eventually breached are included in this group from the start of the study even before they were breached).

Adaptive Management Triggers

Management guidelines are provided by the SBSPRP Adaptive Management Plan (AMP; SBSPRP 2007) to ensure the SBSPRP improves the ecological function and health of San Francisco Bay as part of the Project's NEPA/CEQA requirements. For waterbirds, annual monitoring is used based on monitoring of population abundances and comparing these to "trigger values", with higher thresholds for three-year declines and more strict thresholds for one-year declines (Table 2). Triggers were set based on each population's abundance during 2002–2005, before the start of most management activities. Eared Grebes (*Podiceps nigricollis*), Bonaparte's Gulls (*Chroicocephalus philadelphia*), phalaropes, diving ducks, Ruddy Ducks (*Oxyura jamaicensis*), and small shorebirds have had NEPA/CEQA targets defined, and guidelines have also been established for dabbling ducks and medium shorebirds based on USFWS management goals (South Bay Salt Pond Restoration Project 2007, Tarjan 2019a). However, the AMP triggers are stricter than NEPA/CEQA targets, and were intentionally designed as an early warning system. Targets are set for each species/guilds based on abundances during a single focal season (except for small shorebirds, which have a target for both fall and spring migration; Table 2).

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.

Table 2. Summary of the most recent three-year average waterbird trends (generally water year 2022-2024) compared with SBSPRP targets or baseline values (2005–2007). For phalaropes, counts from the most recent three summers of targeted phalarope surveys (2021-2023; Van Schmidt & Parsons 2024) are compared to a revised July-September baseline (Burns & Van Schmidt 2023). Season = the season(s) in which the taxon's counts are highest. Target = either a comparison to a baseline count without a formal target set (None), a target defined by the SBSPRP Adaptive Management Plan (SBSPRP 2007, Appendix 3), or restoration targets set by USFWS Recovery Plan for Tidal Marsh Ecosystems of Northern and Central California (USFWS 2013), as originally compiled in Tarjan & Heyse (2018). Baseline = the comparison abundance value, generally the 2005-2007 mean seasonal count. Threshold = NEPA/CEQA significance threshold. % Change = difference between the most recent three-year mean counts and Target/Baseline value. Trigger = true if a trigger was detected; for most taxa, triggers were true if two out of the most recent three consecutive years had counts below baseline values, but for PHAL, BOGU, and EAGR, the trigger was three consecutive years more than 25% below target, or any single year more than 50% below target.

Species/Guild	Season	Target	Baseline	Threshold	Percent Change	Trigger	Years Below	Years >25% Below	Years >50% Below
Ruddy Ducks	Winter	AMP	12602	-15	136%	FALSE	0		
Diving ducks	Winter	AMP	39645	-20	35%	FALSE	1		
Small shorebirds	Fall	AMP	60623	-20	44%	FALSE	1		
Small shorebirds	Spring	AMP	73728	-20	4%	TRUE	2		
Eared Grebes	Winter	AMP	5640	-50	35%	FALSE	0	0	0
Phalaropes	Summer	AMP	5324	-50	-71%	TRUE	3	3	3
Bonaparte's Gulls	Winter	AMP	1270	-50	-53%	TRUE	3	1	3
Dabbling ducks	Winter	USFWS	48524		-17%	TRUE	3		
Medium shorebirds	Winter	USFWS	23312		-6%	TRUE	2		
Fisheaters	Fall	None			-19%	TRUE	3		
Herons and egrets	Fall	None			-31%	TRUE	3		
Gulls	Spring	None			-36%	TRUE	3		
Terns	Fall	None			52%	FALSE	0		

Change Model

We iterated on a model relating static pond characteristics, changes in pond characteristics, and annual weather to changes in waterbird abundance in order to identify drivers of observed changes in waterbird populations (Van Schmidt & Parsons 2024). Because summer monitoring efforts are no longer conducted and other recent efforts have assessed changes in breeding waterbird habitat selection in salt ponds vs. tidal marsh (Hartman et al. 2021, Schacter et al. 2023), we assessed only non-breeding (migratory and wintering) populations of waterbirds within South San Francisco Bay. Phalaropes were included in our assessment, but it was based on summer records within the long-term SBSPRP monitoring dataset rather than the new Phalarope Migration Surveys (Van Schmidt & Parsons 2024), which will be the subject of a different report. Least Terns were excluded because they had prohibitively low abundances, which made fitting complex models difficult, and because summer surveys of this target species are now covered by other recent studies at SFBBO (Schwarz et al., 2024).

Model Description

A detailed description of the model development process and methods is provided in Van Schmidt & Parsons (2024). Briefly, we modeled per-pond inter-annual change in abundance of water species or guilds with linear mixed models (package *lme4*), with a random effect for year. Loading and initial reprocessing of habitat variables was done in R v4.1.3 (x86) to permit pulling from Microsoft Access databases, and all other steps were done in R v4.3.1 (x64; R Core Team 2017). For each species/guild, we calculated abundance in a given season as the average count at that pond across all surveys during that season. We calculated response variable, percent change in abundance, as:

% Change in Abundance = Ln(1 + ((Abundance[t] – Abundance[t-1]) / (Abundance[t-1] + 1))) (Eq. 1)

We took the natural log and added 1 to equalize the leverage of percent increases and percent decreases. Because this function is not defined for years where abundance in the first year is zero, we added an adjustment factor of one to the denominator to allow us to capture new colonizations, which could be important for capturing the dynamics of rare species. Zero percent change could indicate either a stable population, or an unoccupied site in both years (i.e., a likely unsuitable site). Because we sought explicitly to model drivers of observed changes in populations, not habitat selection, we removed all rows that were zero in both years from the dataset.

A full list of variables we assessed is in Table 3. Due to the large number of habitat variables assessed, we used a structured model selection procedure based on AICc to create a tractable set of up to 4,096 candidate models per guild/species (described in Van Schmidt & Parsons 2024). AICc provides a way to compare the relative fit of models which penalizes the inclusion of additional covariates to avoid overfitting models. For the present analyses, we selected only the best model (lowest AICc), but note that as a rule of thumb models with AICc <2 higher than the best model are considered highly competitive (Bozdogan 1987). We excluded from the modelset phalarope models that include both TMN and TMX, and gull models that included Salinity and Temp_C together, or any combination of TMN, TMX or Temp_C. Although correlations among these variables were under 0.7, models with these combinations frequently exhibited convergence issues.

Table 3. Predictor variables used to predict change in seasonal mean waterbird abundance within current and former salt ponds of the South San Francisco Bay. “Base” stage variables were included in all models for a given species/guild, if and only if they were significant in De La Cruz et al. (2018), while “Main” indicates AICc model selection was carried on out on the variable (Appendix 5). “Change model” column indicates whether the variable varied was static across years, varied annually, or was modeled as the year-to-year change in this variable (“Change”, with name suffix “_AC”).

Stage	Group	Name	Description	Units	Change model
Base	Site characteristics	Area_km2	Pond area	km2	Static
		Islands_num	Number of islands	count	Static
		OpenPublic_pct	Maximum % of levees open to public across all years	%	Static
		OpenHunting_pct	Maximum % of levees open for hunting across all years	%	Static
		BayDist_km	Distance to San Francisco Bay	km	Static
		CreekDist_km	Distance to creek/slough	km	Static
		LandfillDist_km	Distance to Tri-cities Landfill	km	Static
Main	Hydrology	Breached	Breached to tidal action	Binary 1 / 0	Annual
		Gated	Gated culvert / semi-tidal	Binary 1 / 0	Annual
		WaterElev_m	Mean water depth	cm	Change
		Salinity	Mean salinity	ppt	Annual + Change
		pH	Mean pH	pH scale	Annual + Change
		LDO_mgL	Mean dissolved oxygen	mg/L	Annual + Change
		Temp_C	Mean water temperature	°C	Annual + Change
	Weather	PPT0	Cumulative annual precipitation – year-to-date	mm	Annual
		PPT1	Cumulative annual precipitation – last year’s only	mm	Annual
		PPT3	Cumulative annual precipitation – last three years	mm	Annual
		TMX	Mean daily maximum temperature for the season	°C	Annual
		TMN	Mean daily minimum temperature for the season	°C	Annual

Model Assessment

We assessed goodness-of-fit of the best model for each guild based on R^2. We report two values: (1) R^2c, which is the proportion of variance attributable to both the fixed effect covariates (i.e., the habitat conditions and accounted for weather variables) and the random effect for year (i.e., the unexplained annual variation, which likely represents both broader population trends and unaccounted for weather variables), and (2) R^2m, which is the proportion of variance attributable to only the fixed effect covariates.

To estimate the impact of the habitat changes and weather on trends within the current year, we used an approach based on effect partitioning and counterfactual analysis. We first predicted the expected percent change for each pond included in the model (i.e., excluding ponds that had missing habitat data for some variables and ponds that were unoccupied in both years). We then predicted the percent change at each pond under four counterfactual alternatives with groups of covariates altered: (1) no random effect for year, (2) no change in site hydrology (breached, gated, and water quality measurements set to last year's values, and "AC" water quality change variables set to 0), (3) average weather (weather variable set to their mean long-term value across all site-years), and (4) each static site characteristic set to the mean value across all site-years. Because the log percent change measure is difficult to interpret in terms of meaningful impacts at the population-scale, we transformed site-scale predictions to predicted actual change in mean abundance by applying the inverse of equation Eq. 1 with the actual value of abundance in the previous year t-1. We then summed these values for each alternative scenario across all sites included in the model. The effect of each of the four groups of covariates on change in overall abundance was then calculated as:

Overall Effect = Sum Abundance Change - Sum Abundance Change in Alternative (Eq. 2)

It is important to note that these estimated effect sizes are based on holding other variables at their real values, and additional variation may arise from the intercept term and residual model error. Therefore, estimated effects from each group of models do not sum to the total predicted change, and should only be compared in terms of the relative magnitude and direction of effects rather than a conclusive determination of drivers of abundance change. Furthermore, R^2 values were generally low, with the majority of variation in population changes was unexplained by the models ($R^2 < 0.5$). Therefore, the ponds with the greatest predicted changes are not always those with the greatest actual change. We report pond-scale changes to draw attention to where changes in site hydrology are most likely to have negatively impacted the birds, but these predictions should be cross-referenced with actual changes and on-the-ground knowledge of pond conditions to understand potential impacts.

Interpreting the results this model can be challenging because a positive relationship between a predictor variable and percent change in population size could be the result of that predictor driving population growth, population declines, or both, and could be the result of increases or decreases in the relevant habitat variable. Thus, for a bird that prefers low-salinity habitat, a positive relationship between changes in salinity could be the result of a population growing as salinity falls in one pond, or declining as salinity rises in another. For this report, we focus on reporting whether each term is a direct (positive) relationship, or an indirect (negative) relationship. For all variables, however, it is important to keep in mind that the observed relationships may have multiple potential explanations.

Model Improvements

Compared to the original report, four notable changes are worth highlighting. First, the response variable was changed from total sightings per target season to mean abundance per target season, to better align with other analyses. Second, Horned Grebe and Black Skimmer were both reclassified as fisheaters, in line with other SFBBO analyses (they had previously been grouped with guilds Eared Grebe and terns, respectively, following USGS guild definitions). Third, we trimmed the dataset to only rows of complete cases for all variables included in the final modelset, in order to increase the validity of AICc comparisons by ensuring the sample size of each candidate model was the same. Lastly, we constrained weather terms to only allow for a single precipitation variable (PPT0, PPT1, or PPT3), as including more than one of these variables in the same model often caused convergence problems.

Results

Overview

Abundance and Trends

Overall, we recorded 782,826 total sightings of 86 waterbird species in the Alviso, Coyote Hills, Dumbarton, Eden Landing, Mowry, and Ravenswood pond complexes from September 2023 to May 2024 (Table 4, Fig. 2). This was 463,246 fewer waterbirds than were detected over the same timespan last year (-37.2%; Fig. 3). This trend was driven by notable decreases in small shorebirds (-260,259 sightings; -48.1%), diving ducks (-98,816 sightings; -43.4%), Ruddy Ducks (-45,094 sightings; -36.4%), medium shorebirds (-30,646 sightings; -25.1%), dabbling ducks (-28,818 sightings; -15.3%), gulls (-22,381 sightings; -26.3%), and Eared Grebes (-22,199 sightings; -44.8%), which outpaced notable increases in Bonaparte's Gulls (+2,420 sightings; +154.5%) and herons and egrets (+668 sightings; +25.6%) (Appendix 2; Table A2.2). The remaining guilds had minor changes, with slight increases in phalaropes (+31 sightings; +0.6%) and slight decreases in fisheaters (-1,380 sightings; -7.9%) and terns (-410 sightings; -6.7%) (Table A2.2). The Alviso complex supported the highest overall bird count and the Alviso complex had the highest species richness. The Dumbarton complex had both the lowest overall bird count and the lowest species richness.

Abundance of 6 out of 13 taxa assessed (counting small shorebirds twice in both fall and spring) have increased in SBSPRP ponds since 2005-2007, prior to the onset of most restoration activities. Exceptions comprise phalaropes, Bonaparte's Gulls, dabbling ducks, medium shorebirds, fisheaters, herons and egrets, and gulls. As a result of low abundance over the past three survey years, management triggers are currently passed for 8 species/guilds: Bonaparte's Gulls, dabbling ducks, fisheaters, gulls, herons and egrets, medium shorebirds, phalaropes, and small shorebirds. Note that because triggers could be activated based on just two of the last three years being below the baseline (or for saline specialists just one year more than 50% below), it is possible for a trigger to be TRUE even if the current three-year average is above the baseline.

Table 4. Waterbird species richness, abundance (total sightings for all species combined), and acreage by pond complex and individual pond, South San Francisco Bay, California; September 2023 - May 2024.

Complex	Pond	Species Richness	Total Sightings	% of Total Sightings	% Total Area	Most Common Taxa
Alviso	A1	36	13,451	1.72	1.38	DIVER
	A10	45	5,004	0.64	1.26	DIVER
	A11	42	4,123	0.53	1.32	DIVER
	A12	10	3,962	0.51	1.55	GULL
	A13	21	5,165	0.66	1.35	SMSHORE
	A14	42	22,158	2.83	1.71	DABBLER
	A15	16	4,850	0.62	1.27	SMSHORE
	A16	52	20,694	2.64	1.22	DABBLER
	A17	34	5,101	0.65	0.66	DABBLER
	A19	22	7,892	1.01	1.32	DABBLER
	A22	26	4,666	0.60	1.35	SMSHORE
	A23	16	4,462	0.57	2.25	GULL
	A2E	36	11,154	1.42	1.60	DIVER
	A2W	38	9,801	1.25	2.16	DIVER
	A3N	25	2,882	0.37	0.83	MEDSHORE
	A3W	41	25,438	3.25	2.82	DIVER
	A5	53	14,332	1.83	3.17	DIVER
	A6S	15	727	0.09	1.38	DABBLER
	A7	47	14,664	1.87	1.33	DABBLER
	A8	44	5,511	0.70	2.04	DIVER
	A8S	46	4,160	0.53	0.84	DIVER
	A8W	33	1,877	0.24	0.08	DABBLER
	A9	42	23,390	2.99	1.83	DABBLER
	AB1	34	12,696	1.62	0.76	MEDSHORE
	AB2	43	14,379	1.84	0.90	DABBLER
	Subtotal	78	242,539	30.98	36.37	DABBLER
Coyote Hills	N1A	44	4,140	0.53	0.83	DIVER
	N2A	35	10,513	1.34	0.84	DIVER
	N3A	41	14,728	1.88	2.07	GULL
	N4	25	4,332	0.55	1.68	MEDSHORE
	N4AA	41	7,566	0.97	1.49	DIVER
	N4AB	40	13,067	1.67	1.17	DABBLER
	N4B	27	3,193	0.41	0.32	SMSHORE
	N5	24	770	0.10	0.95	FISHEAT
	N6	25	2,991	0.38	0.46	GULL
	N7	29	4,778	0.61	1.88	GULL
	N8	27	1,938	0.25	0.56	SMSHORE
	N9	33	6,603	0.84	0.67	GULL
	Subtotal	58	74,619	9.53	12.91	DABBLER
Dumbarton	N1	29	11,001	1.41	1.70	DABBLER
	N2	19	220	0.03	0.96	DABBLER
	N3	29	2,660	0.34	2.72	MEDSHORE
	NPP1	28	14,792	1.89	0.95	SMSHORE
	Subtotal	42	28,673	3.66	6.32	DABBLER

Complex	**Pond**	**Species Richness**	**Total Sightings**	**% of Total Sightings**	**% Total Area**	**Most Common Taxa**
Eden Landing	CP3C	39	14,502	1.85	0.82	SMSHORE
	E1	34	4,571	0.58	1.46	DIVER
	E10	39	7,015	0.90	1.06	DIVER
	E11	26	2,052	0.26	0.62	MEDSHORE
	E12	45	144,80	1.85	0.53	SMSHORE
	E13	40	190,18	2.43	0.71	SMSHORE
	E14	22	18,055	2.31	0.82	SMSHORE
	E1C	22	2,893	0.37	0.32	SMSHORE
	E2	51	13,854	1.77	3.37	SMSHORE
	E2C	27	5,416	0.69	0.14	SMSHORE
	E4	32	5,238	0.67	0.96	MEDSHORE
	E4C	25	14,981	1.91	0.87	SMSHORE
	E5	23	5,005	0.64	0.82	DABBLER
	E5C	25	7,098	0.91	0.47	SMSHORE
	E6	26	3,238	0.41	0.96	SMSHORE
	E6A	47	15,664	2.00	1.58	SMSHORE
	E6B	32	15,236	1.95	1.40	SMSHORE
	E6C	24	4,037	0.52	0.41	DABBLER
	E7	34	6,471	0.83	1.07	DABBLER
	E8	35	6,887	0.88	0.93	MEDSHORE
	E8AE	19	1,432	0.18	0.65	SMSHORE
	E8AW	18	1,644	0.21	0.60	MEDSHORE
	E8XN	16	705	0.09	0.05	DIVER
	E8XS	9	106	0.01	0.16	SMSHORE
	E9	34	9,441	1.21	1.87	SMSHORE
	Subtotal	72	199,039	25.43	22.64	DABBLER
Mowry	M1	28	27,067	3.46	2.45	SMSHORE
	M2	28	39,410	5.03	2.39	DABBLER
	M3	27	27,611	3.53	2.71	SMSHORE
	M4	20	9,900	1.26	2.64	EAREDGR
	M5	19	10,423	1.33	2.05	SMSHORE
	M6	20	7,484	0.96	2.20	SMSHORE
	Subtotal	43	12,1895	15.57	14.44	DABBLER
Ravenswood	R1	40	54,519	6.96	2.22	SMSHORE
	R2	23	20,300	2.59	0.70	SMSHORE
	R3	24	1,559	0.20	1.40	DABBLER
	R4	20	6,752	0.86	1.47	SMSHORE
	R5	18	697	0.09	0.15	SMSHORE
	R5S	14	287	0.04	0.15	SMSHORE
	RSF2U1	41	17,298	2.21	0.28	MEDSHORE
	RSF2U2	40	10,947	1.40	0.41	MEDSHORE
	RSF2U3	21	1,971	0.25	0.44	SMSHORE
	RSF2U4	20	1,731	0.22	0.08	DIVER
	Subtotal	54	116,061	14.83	7.31	DABBLER
Study Area	Total	87	782,826	100.00	100.00	SMSHORE

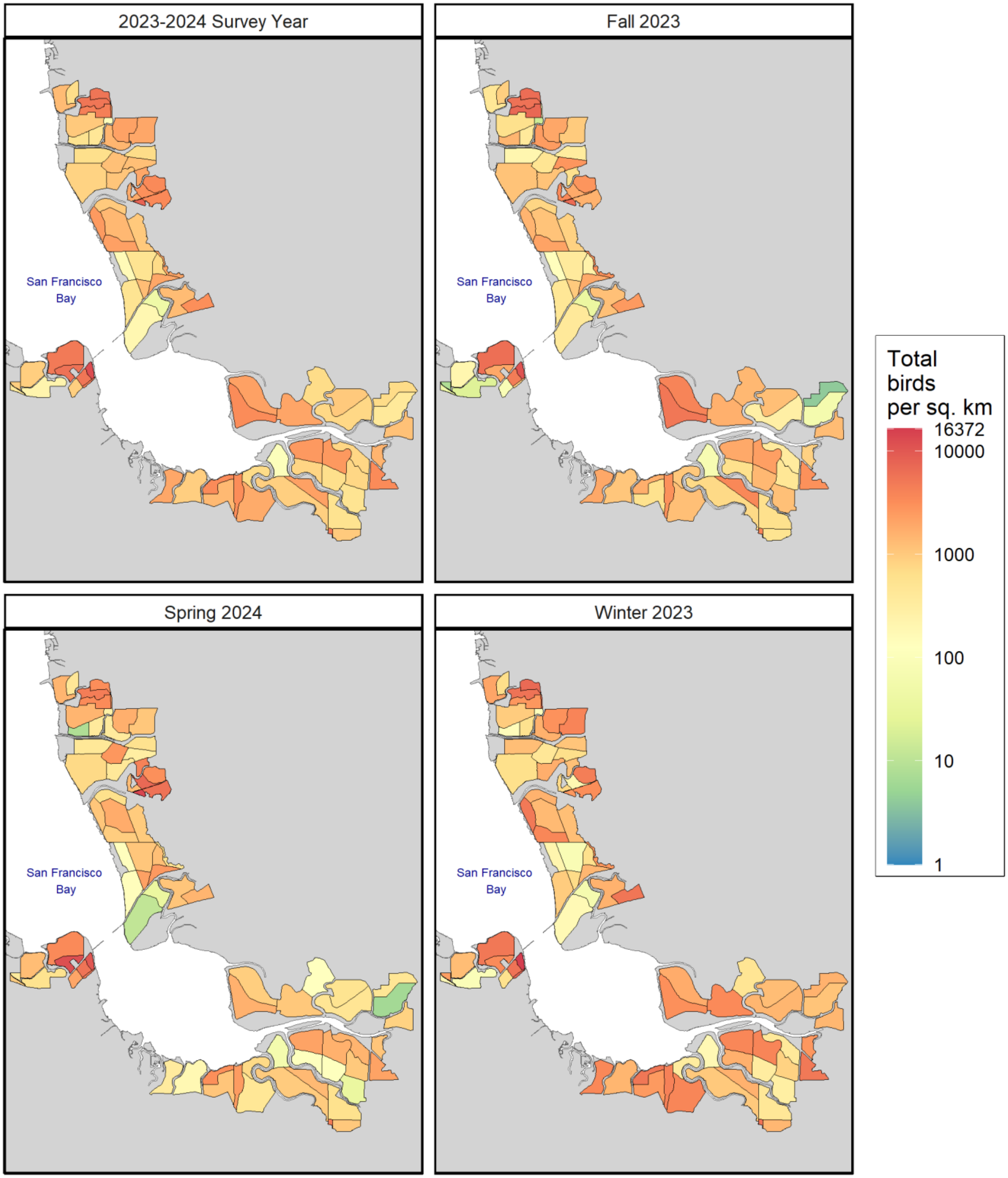

Figure 2. Density of waterbirds (all guilds) averaged across survey rounds by season, South San Francisco Bay, California; September 2023–May 2024. Dark grey ponds had no birds.

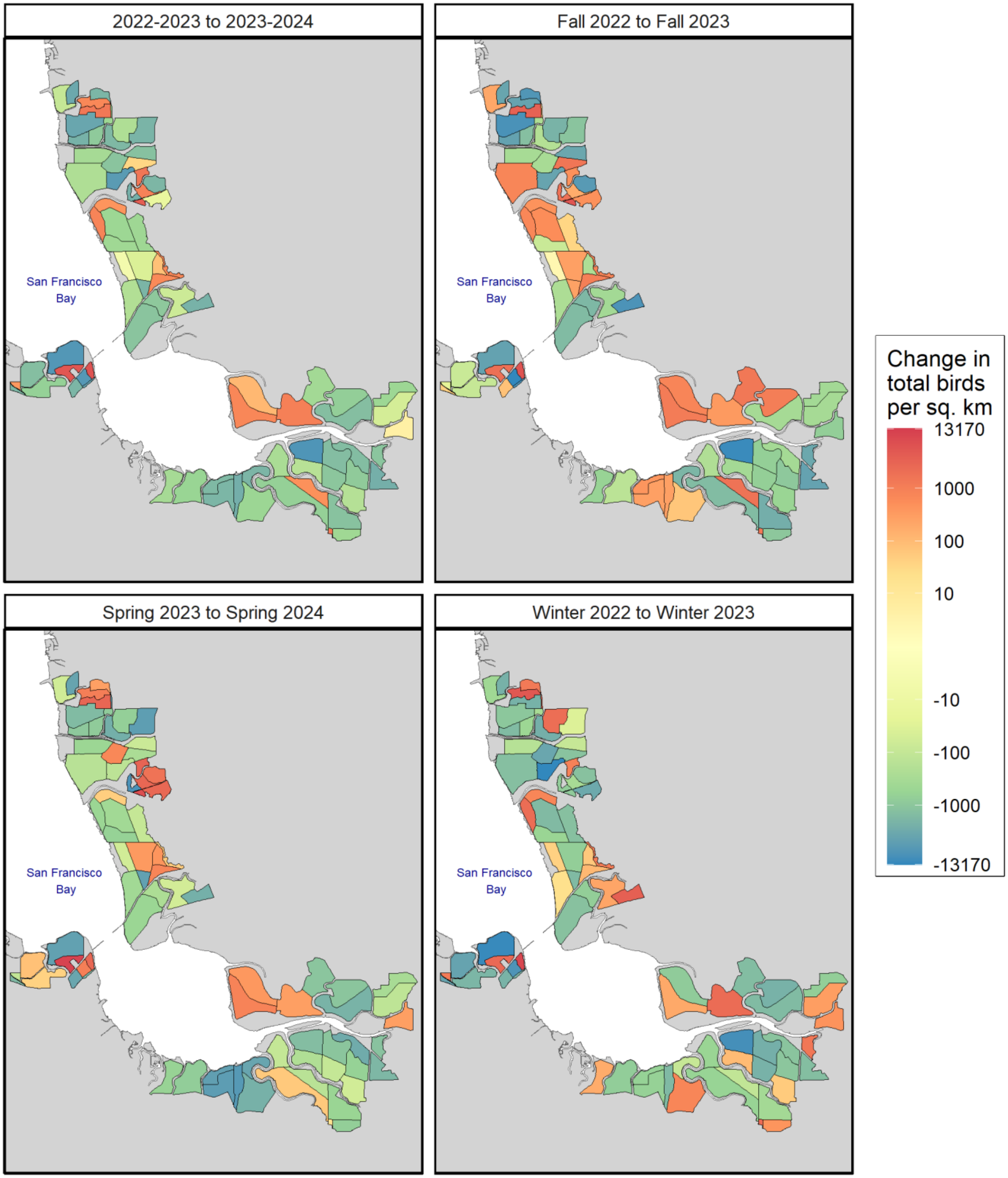

Figure 3. Change in density of waterbirds (all guilds) between September 2022–May 2023 and September 2023–May 2024, averaged across survey rounds by season, in pond habitats of South San Francisco Bay, California. Dark grey ponds had no birds in both seasons.

Pond Conditions

Changes in abundance from year to year (Appendix 2) and season to season (Appendix 3) are likely driven by both the timing of species' migrations, weather, and by changes in pond conditions (Appendices 6, 7). Water level and quality parameters likely affected prey availability of foraging birds, contributing to observed guild distribution patterns (Velasquez 1992, Warnock et al. 2002, Takekawa et al. 2006). We found that in Cargill-managed ponds, water quality parameters (Table A6.1) had positive, negative, and no effects on guild abundances (Appendix 5), depending on the guild and the water quality parameter, in agreement with other studies (Scullen et al. 2013, De La Cruz et al. 2018). 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. 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 (Figs. A7.1 – A7.8). Over the course of the year, ponds A8, A17, and A19 (a pond with a muted tidal gate and two breached ponds) were the least saline ponds monitored, while ponds A12, R2, and A15 were the most saline (Figs. A7.1 – A7.4). Since cold water tends to hold more dissolved oxygen, ponds tended to show higher dissolved oxygen concentrations in winter months (Figs. A7.9 – A7.12). pH values varied between ponds, but did not generally show seasonal fluctuations (Figs. A7.13 – A7.16). 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). Staff gauge readings also showed significant season fluctuations in water levels, and some were often dry enough that no water reached the staff gauge such that no staff gauge reading is available for that survey period. (Figs. A7.17 – A7.20). Several other ponds lack staff gauges for the entire study period: A10, A11, A12, A15, A19, A22, A23, A2E, A6S, A8, A8S, A8W, N4AB, N4B, NPP1, E4C, E6, E7, E8AE, E8AW, M4, M6, R3, R4, R5, R5S (Table A8.1).

Because annual weather conditions—both air temperature and precipitation—can affect the hydrologic conditions within ponds, it is challenging to disentangle the ultimate drivers of changes in pond abundance. In the subsequent sections we attribute predicted changes in abundance to changes in hydrologic conditions. Managers should interpret such data in conjunction with their own knowledge of what management actions were taken in what ponds to identify where changes in conditions are likely the result of changes in management, versus being driven by weather.

Waterbird Guilds

Dabblers

Abundance

Across all complexes, there were 159,602 total sightings of dabbling ducks (sum sightings during the entire survey period). Compared to last year, this was a decrease of 28,818 total sightings (-15.3%; Fig. 4). There were on average 6,012 fewer dabbling ducks detected per survey in fall (Table A2.4), 3,432 fewer detected in winter (Table A2.6), and 4,966 fewer detected in spring (Table A2.8, Fig. 4).

At the pond level, M2 had the highest abundance (mean count of 2,687 per survey), followed by A14 (2,590) and A16 (2,438; Fig. 5). At these sites, we observed the majority of dabbling ducks roosting on the pond (54.2%), foraging (74.8%), and roosting on the pond (57.8%), respectively (Table A4.2). Across all six surveys, the sites with the largest increases in dabbling ducks from last year were M2 (+2,663 mean abundance per visit), A7 (+1,100), and AB2 (+699, while the sites with the largest decreases were A2E (-2,070), E4 (-1,454), and RSF2U2 (-1,094; Fig. 6). At M2 (4,301 birds in fall), abundance of dabbling ducks was higher than ever previously recorded there.

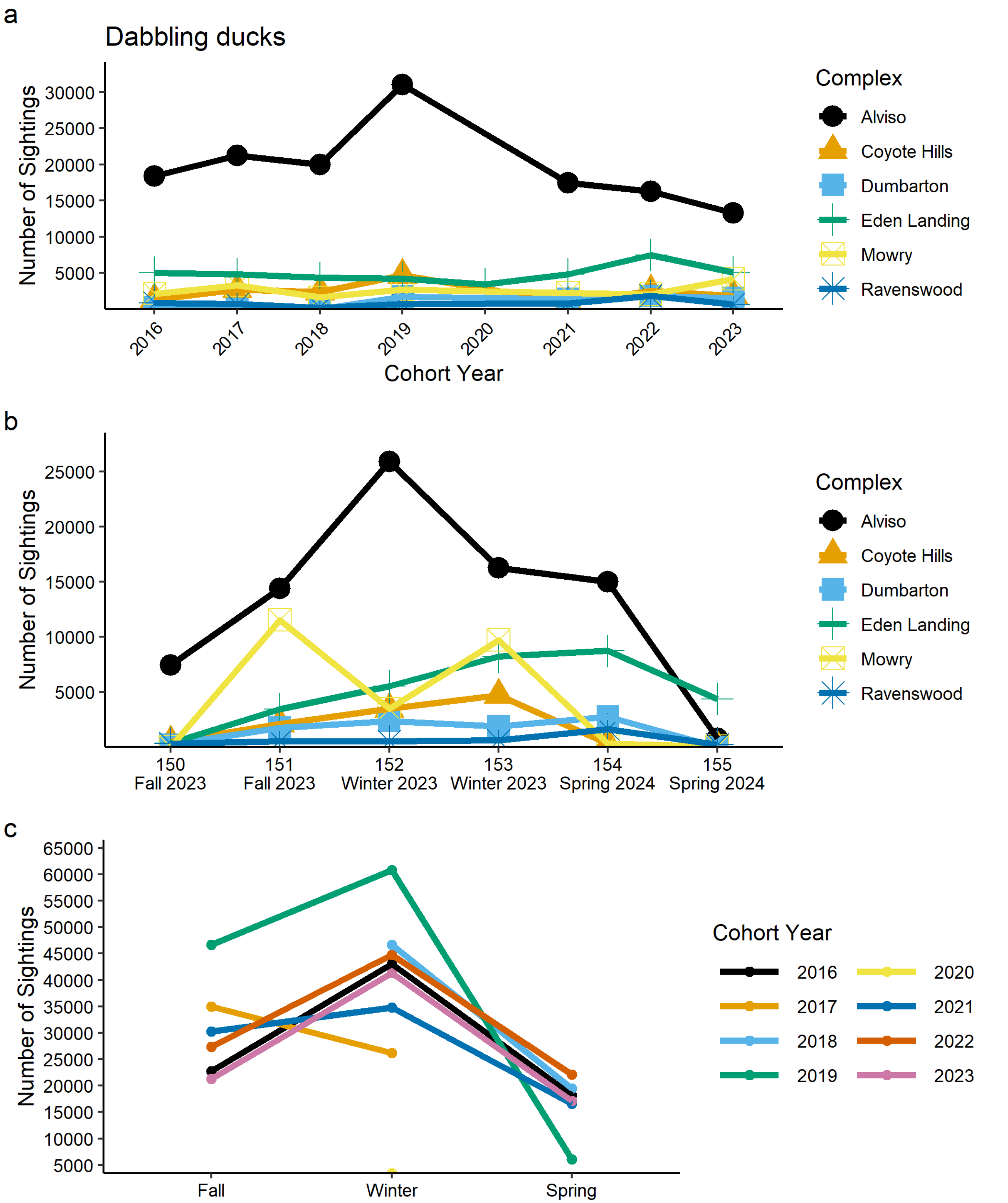

Figure 4. Abundance of dabbling ducks by (a) study year (September to August of the following year) for each complex (averaged across surveys), (b) survey period for each complex during the current report period (September 2023 – May 2024), and (c) season for each study year at all salt production ponds combined; South San Francisco Bay, California, Sept. 2005 – May 2024 (averaged across surveys). Study years 2019 and 2020 contain incomplete survey rounds.

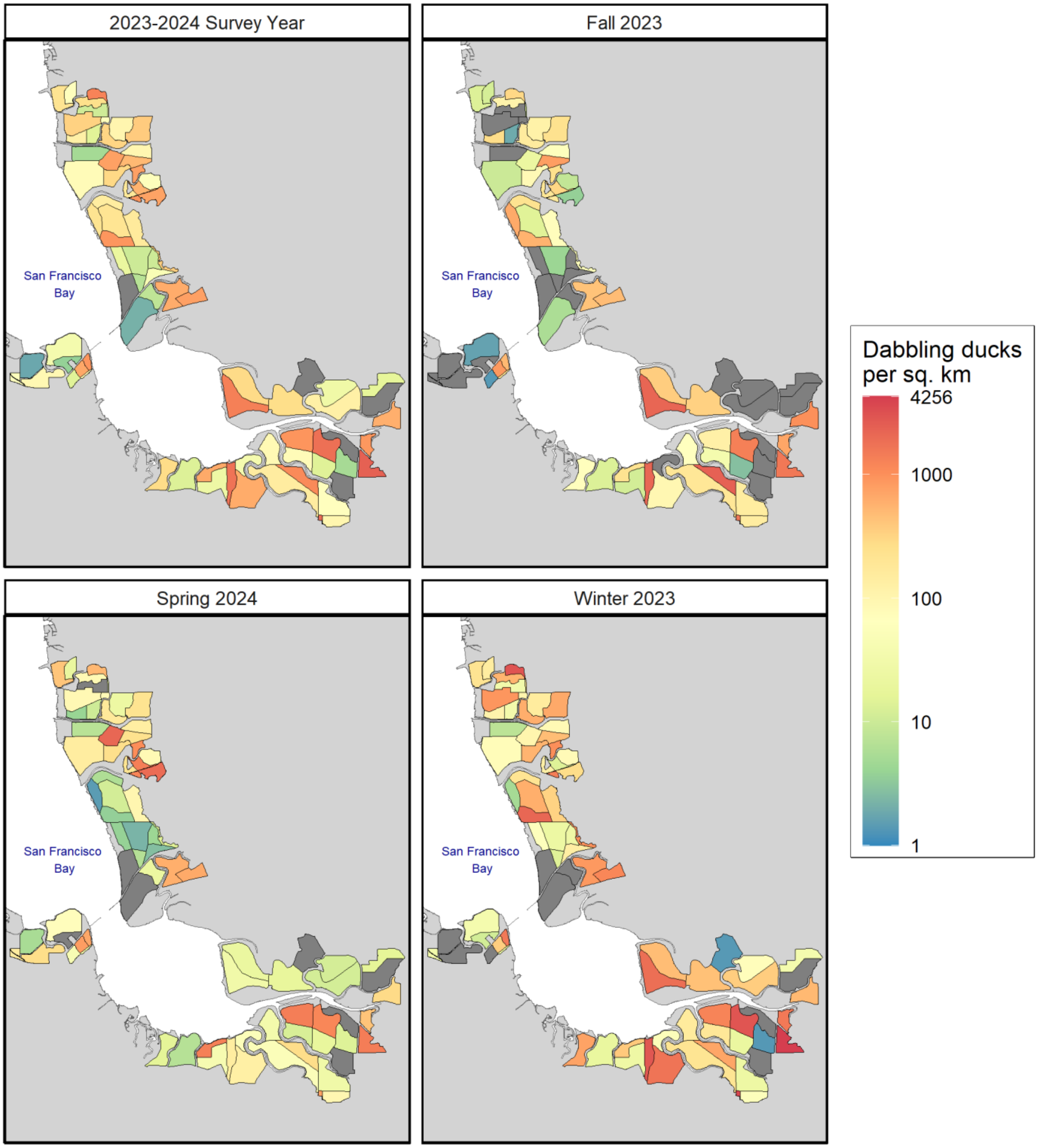

Figure 5. Density of dabbling ducks averaged across survey rounds by season, South San Francisco Bay, California; September 2023–May 2024. Dark grey ponds had no birds.

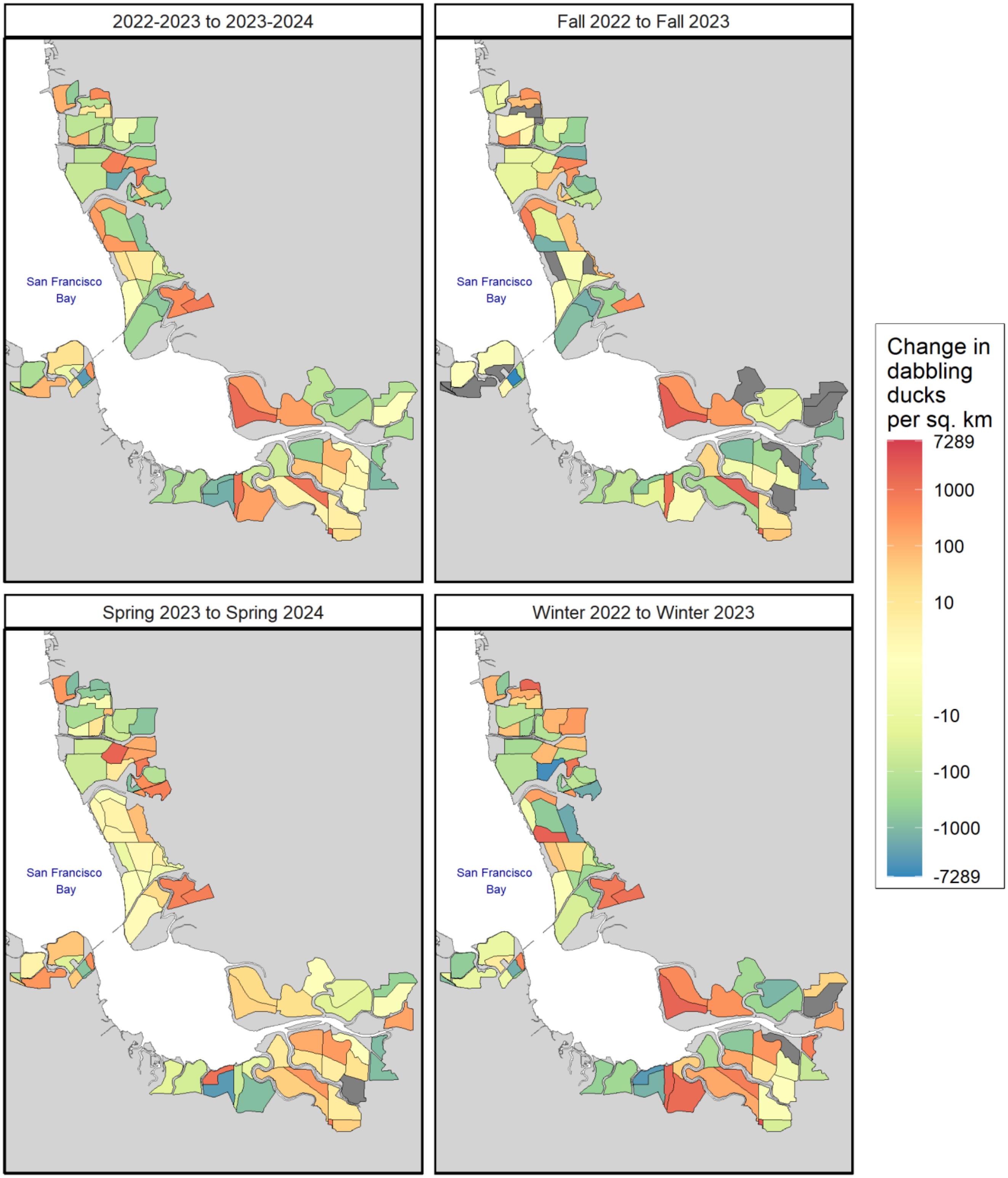

Figure 6. Interannual change in density of dabbling ducks between September 2022–May 2023 and September 2023–May 2024 in pond habitats of South San Francisco Bay, California. Seasonal panels are density averaged across survey rounds by season, while the Overall panel is averaged across all six survey periods. Dark grey ponds had no birds during that seasonal window in both the current and previous year.

Trends and Trigger Status

For dabbling ducks in winter, their management trigger—two or more of the past three years of winter abundance below the 2005-2007 baseline value—was tripped this year because average seasonal abundance was below this threshold in all three of the three most recent years of complete surveys (Table 2). The estimated multi-year trend for average winter abundance of dabbling ducks across the study area was -1,930 at the end of winter 2024. The trend within the SBSPRP-managed wildlife ponds (-78.77 per km^2, -2,185 total) was worse than the trend within the Cargill-managed salt ponds (+18.36 per km^2, +509 total). The trend within SBSPRP ponds that had been breached to restore tidal marsh was in-between the wildlife ponds and salt ponds (+0.04 per km^2, +1 total; Fig. 7).

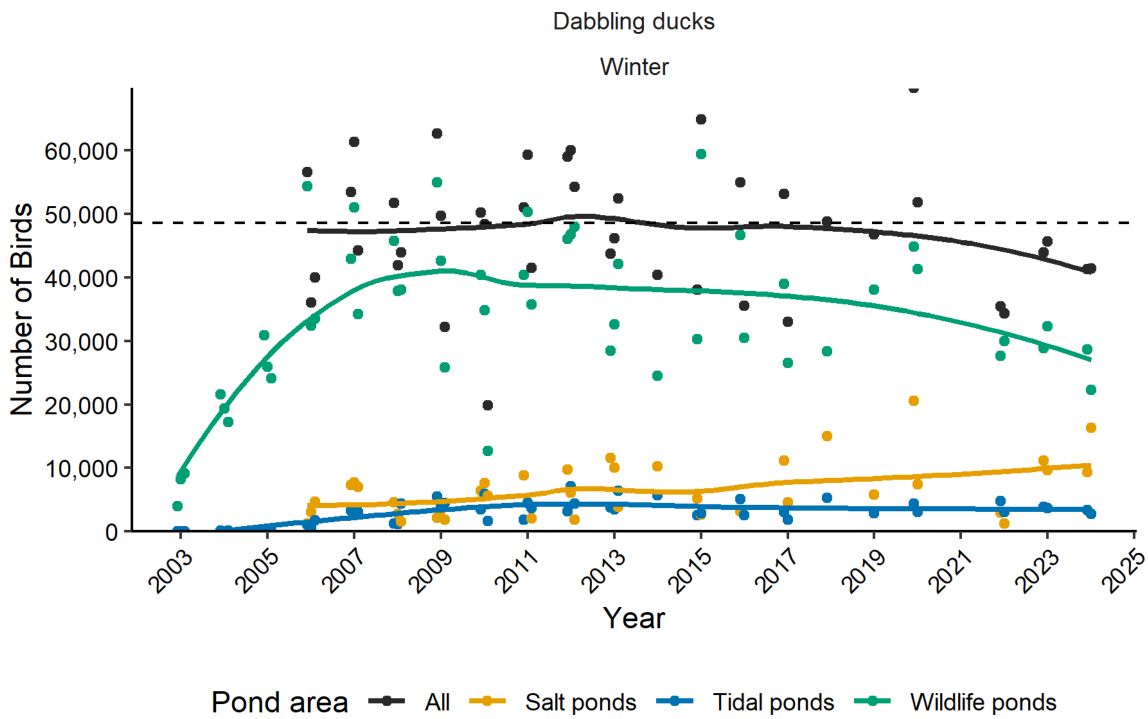

Figure 7. Counts of dabbling ducks during target season(s) within the South Bay Salt Pond Restoration Project (SBSPRP) and salt production ponds. Lines represent LOESS curves and the dashed lines denote SBSPRP targets or baseline values (average counts from 2005-2007). Ponds A20, A21, A6N, and E10X were excluded from analysis because they were not surveyed after tidal restoration.

Change Model

Increases in dabbling duck abundance were most strongly driven by reductions in pond salinity (Fig. 8). De La Cruz et al. (2018) found that dabbling ducks were most abundant on ponds with low salinity (≤33 ppt), though Scullen et al. (2013) did not find support for such a relationship in the salt production pond complexes. Higher precipitation in the previous year was also significantly positively related to change in abundance of dabbling ducks. The other covariates had 95% confidence intervals that overlapped zero, though a positive relationship between dissolved oxygen and increases in abundance was still supported by AICc model selection (Table A5.1). A positive relationship with dissolved oxygen may be the result of its benefits for invertebrate prey abundance (Scullen et al. 2013). For both salinity and dissolved oxygen, changes in water quality parameters more strongly drove changes in abundance than the parameters themselves. De La Cruz et al. (2018) also found that islands and lower percentage of the pond open to hunting predict higher abundance by De La Cruz et al. (2018), which our results also supported, though more weakly.

We report predictions made by the change model within 75 ponds, excluding sites that were unoccupied by dabbling ducks in winter of both 2024 and 2023 (A15 and A23) and sites with missing water quality measurements (A19, A8W, E8AE and E8AW). Across this set of sites, the actual change in abundance of dabbling ducks in winter was -4,035. In comparison, the model predicted a total change of -6,582, with this decrease driven by effects of changes in site hydrology. The proportion of variance in percent change in counts explained by the best model was low ($R^2c = 0.15$, $R^2m = 0.09$).

The change model estimated that changes in site hydrology could explain a 6,192 decrease in abundance of dabbling ducks from last year due to increasing salinity. The sites predicted to experience the largest increase in dabbling ducks abundance due to hydrology changes were A16, A2E, and E1C, while the sites predicted to experience the largest increase in suitability (i.e., predicted percent change irrespective of actual abundance last year) were A22, N8, and E1C (Table 5). The sites predicted to experience the largest negative impacts from changes in hydrology in winter 2024 were M5, M4, and E4 (based on predicted decreases in abundance) and R4, A13, and M4 (based on predicted decrease in suitability). Static site characteristics (number of islands and hunting access) accounted for an increase of 629 birds.

The change model predicted that deviations from mean weather could drive a 14,906 increase in abundance due to high precipitation last year (Table 5). There was also a substantial amount of change in abundance attributable to the unexplained annual variability (the random year effect), with this term in 2024 decreasing abundance by 35,581, some of which is likely due to complex effects of weather not included in the model.

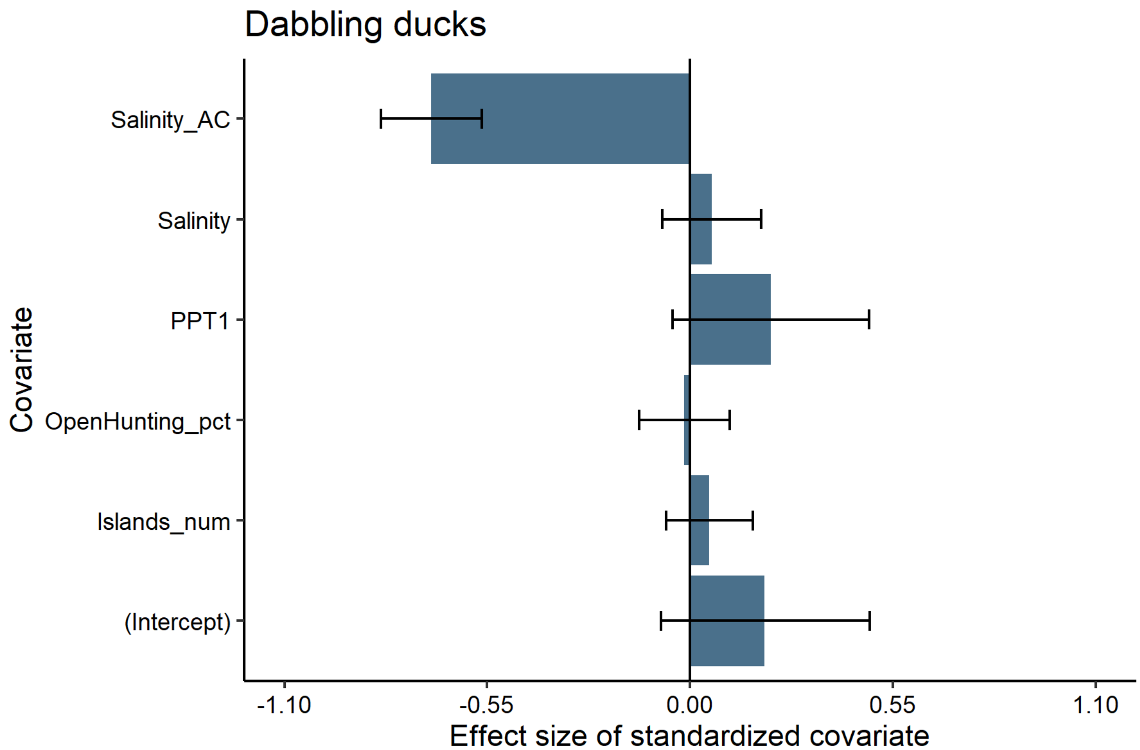

Figure 8. Fixed effects for the top model for interannual change in abundance of dabbling ducks during winter in current and former salt ponds in South San Francisco Bay, California, water year 2003–2024 (n = 1,247). Dark bars show coefficients and error bars show 95% confidence intervals.

Table 5. Actual and predicted changes in mean abundance per survey of dabbling ducks from winter 2023 to winter 2024 (sorted greatest decrease to greatest increase). Predicted effect sizes of covariate groups are shown for hydrology (salinity; compared to no change from last year), weather (precipitation last year; compared to mean annual weather), static site characteristics (number of islands and hunting access; compared to mean across all sites), and a year random effect. Change values were calculated by back-transforming the predictions on the ln(% change + 1) scale (shown in parentheses and interpretable as change in relative habitat suitability) and then multiplying by the actual previous year's abundance.

Pond	**Previous abun.**	**Current abun.**	**Actual change**	**Predicted change**	**Hydrology effect**	**Weather effect**	**Site effect**	**Year effect**
E4	4,848	436	-4,411 (-2.41)	-726 (-0.16)	-1,081 (-0.23)	+1,727 (+0.54)	+113 (+0.03)	-3,744 (-0.65)
N4AA	2,812	400	-2,412 (-1.95)	-302 (-0.11)	-285 (-0.11)	+1,025 (+0.52)	-32 (-0.01)	-2,280 (-0.65)
AB1	2,448	245	-2,204 (-2.30)	-216 (-0.09)	+31 (+0.01)	+791 (+0.44)	-35 (-0.02)	-2,028 (-0.65)
M5	2,142	243	-1,898 (-2.17)	-1,182 (-0.80)	-1,500 (-0.94)	+336 (+0.43)	+61 (+0.07)	-872 (-0.65)
A2E	1,806	34	-1,771 (-3.93)	-157 (-0.09)	+37 (+0.02)	+583 (+0.44)	-46 (-0.03)	-1,498 (-0.65)
E3C	1,345	182	-1,163 (-2.00)	-58 (-0.04)	-142 (-0.10)	+531 (+0.53)	+63 (+0.05)	-1,170 (-0.65)
A9	2,856	1,898	-958 (-0.41)	-374 (-0.14)	-99 (-0.04)	+880 (+0.44)	-32 (-0.01)	-2,255 (-0.65)
N3A	1,942	1,030	-912 (-0.63)	-189 (-0.10)	-179 (-0.10)	+717 (+0.53)	-22 (-0.01)	-1,592 (-0.65)
R4	630	0	-630 (-6.45)	-600 (-3.02)	-594 (-3.01)	+12 (+0.49)	-0 (-0.01)	-28 (-0.65)
RSF2U2	683	122	-560 (-1.71)	+131 (+0.18)	-85 (-0.10)	+305 (+0.47)	+231 (+0.33)	-741 (-0.65)
A1	1,362	848	-514 (-0.47)	-422 (-0.37)	-333 (-0.30)	+337 (+0.44)	+17 (+0.02)	-855 (-0.65)
M6	502	5	-498 (-4.43)	-13 (-0.03)	-62 (-0.12)	+174 (+0.44)	-6 (-0.01)	-446 (-0.65)
A2W	530	36	-494 (-2.65)	-56 (-0.11)	-29 (-0.06)	+170 (+0.44)	+16 (+0.03)	-432 (-0.65)
N2	495	1	-494 (-5.51)	-58 (-0.12)	-87 (-0.18)	+172 (+0.50)	+15 (+0.03)	-398 (-0.65)
E5	805	322	-482 (-0.91)	+53 (+0.06)	+17 (+0.02)	+362 (+0.55)	-44 (-0.05)	-780 (-0.65)
E2	564	210	-354 (-0.98)	+54 (+0.09)	+2 (+0.00)	+263 (+0.55)	+31 (+0.05)	-562 (-0.65)
E11	362	76	-286 (-1.56)	+1 (+0.00)	-4 (-0.01)	+161 (+0.59)	-19 (-0.05)	-330 (-0.65)
E1C	313	34	-280 (-2.21)	+46 (+0.14)	+34 (+0.10)	+149 (+0.54)	-5 (-0.01)	-327 (-0.65)
E1	280	9	-270 (-3.33)	-13 (-0.05)	-13 (-0.05)	+115 (+0.56)	-9 (-0.03)	-243 (-0.65)
A6S	412	184	-228 (-0.81)	-45 (-0.12)	-3 (-0.01)	+131 (+0.44)	-5 (-0.01)	-334 (-0.65)
E9	1,559	1,402	-158 (-0.11)	+6 (+0.00)	-41 (-0.03)	+683 (+0.57)	-29 (-0.02)	-1,422 (-0.65)
N9	231	78	-154 (-1.08)	-21 (-0.10)	-17 (-0.08)	+83 (+0.50)	-3 (-0.01)	-192 (-0.65)
E8	576	476	-100 (-0.19)	-78 (-0.15)	-68 (-0.13)	+213 (+0.56)	-25 (-0.05)	-452 (-0.65)
RS5	107	8	-99 (-2.48)	-17 (-0.17)	-13 (-0.13)	+36 (+0.50)	-1 (-0.01)	-83 (-0.65)

Pond	Previous abun.	Current abun.	Actual change	Predicted change	Hydrology effect	Weather effect	Site effect	Year effect
N3	74	0	-74 (-4.32)	-6 (-0.09)	-15 (-0.19)	+27 (+0.50)	+6 (+0.10)	-63 (-0.65)
N6	78	6	-72 (-2.50)	+3 (+0.03)	+4 (+0.05)	+32 (+0.50)	-1 (-0.01)	-74 (-0.65)
A16	4,356	4,285	-70 (-0.02)	-40 (-0.01)	+211 (+0.05)	+1,445 (+0.41)	+275 (+0.07)	-3,920 (-0.65)
N4B	319	256	-63 (-0.22)	-47 (-0.16)	-40 (-0.14)	+109 (+0.51)	-3 (-0.01)	-248 (-0.65)
E4C	168	117	-52 (-0.36)	+41 (+0.22)	+15 (+0.08)	+88 (+0.54)	+16 (+0.08)	-191 (-0.65)
E8X	54	22	-32 (-0.87)	-2 (-0.03)	-2 (-0.03)	+23 (+0.57)	-3 (-0.05)	-48 (-0.65)
E5C	38	11	-26 (-1.17)	-1 (-0.02)	-2 (-0.05)	+16 (+0.54)	-0 (-0.01)	-34 (-0.65)
R3	25	0	-25 (-3.26)	-11 (-0.53)	-11 (-0.54)	+6 (+0.49)	-0 (-0.01)	-14 (-0.65)
A8S	62	38	-24 (-0.47)	-11 (-0.18)	-2 (-0.03)	+18 (+0.42)	-2 (-0.03)	-48 (-0.65)
RSF2U4	26	3	-23 (-1.91)	-4 (-0.15)	-2 (-0.08)	+9 (+0.46)	-0 (-0.01)	-21 (-0.65)
N8	24	12	-12 (-0.67)	+5 (+0.18)	+5 (+0.19)	+12 (+0.51)	-0 (-0.01)	-28 (-0.65)
A13	11	3	-8 (-1.10)	-9 (-1.47)	-9 (-1.46)	+1 (+0.42)	+0 (+0.02)	-2 (-0.65)
R5	10	4	-6 (-0.79)	-3 (-0.28)	-2 (-0.24)	+3 (+0.50)	-0 (-0.01)	-8 (-0.65)
N4	4	0	-4 (-1.61)	-1 (-0.19)	-1 (-0.18)	+2 (+0.50)	-0 (-0.01)	-4 (-0.65)
RSF2U3	4	0	-4 (-1.61)	-3 (-1.02)	-3 (-1.00)	+1 (+0.47)	-0 (-0.01)	-2 (-0.65)
N2A	6	4	-3 (-0.51)	-1 (-0.08)	-1 (-0.08)	+3 (+0.53)	-0 (-0.01)	-6 (-0.65)
A8	44	42	-2 (-0.06)	-7 (-0.16)	-0 (-0.00)	+13 (+0.42)	-1 (-0.03)	-35 (-0.65)
A12	0	1	+1 (+0.69)	-0 (-0.59)	-1 (-0.75)	+0 (+0.42)	-0 (-0.01)	-1 (-0.65)
R2	6	13	+7 (+0.69)	-0 (-0.06)	-0 (-0.04)	+3 (+0.48)	-0 (-0.03)	-6 (-0.65)
A11	13	23	+10 (+0.54)	-1 (-0.07)	+0 (+0.04)	+4 (+0.42)	-0 (-0.01)	-12 (-0.65)
A3N	12	38	+25 (+1.05)	-1 (-0.07)	+0 (+0.04)	+4 (+0.44)	-1 (-0.04)	-11 (-0.65)
E2C	135	160	+26 (+0.17)	-7 (-0.05)	-8 (-0.06)	+54 (+0.53)	+0 (+0.00)	-118 (-0.65)
N7	8	36	+28 (+1.43)	-2 (-0.26)	-2 (-0.25)	+3 (+0.51)	-0 (-0.01)	-6 (-0.65)
E6	36	68	+32 (+0.62)	-3 (-0.08)	-4 (-0.10)	+14 (+0.55)	-1 (-0.03)	-31 (-0.65)
E14	9	43	+34 (+1.48)	-0 (-0.02)	-0 (-0.02)	+4 (+0.57)	-0 (-0.05)	-9 (-0.65)
R1	82	130	+48 (+0.46)	-5 (-0.06)	+2 (+0.03)	+30 (+0.48)	-4 (-0.05)	-71 (-0.65)
E7	23	90	+68 (+1.34)	-2 (-0.10)	-3 (-0.11)	+9 (+0.55)	-0 (-0.02)	-20 (-0.65)
A22	12	80	+68 (+1.83)	+3 (+0.20)	+4 (+0.27)	+5 (+0.43)	-0 (-0.01)	-14 (-0.65)
N5	22	92	+70	-5	-5	+7	-0	-16

Pond	Previous abun.	Current abun.	Actual change	Predicted change	Hydrology effect	Weather effect	Site effect	Year effect
			(+1.40)	(-0.24)	(-0.24)	(+0.51)	(-0.01)	(-0.65)
E13	256	328	+72	-8	-9	+109	-13	-226
			(+0.25)	(-0.03)	(-0.04)	(+0.58)	(-0.05)	(-0.65)
E10	106	188	+82	+14	+5	+54	+1	-110
			(+0.57)	(+0.12)	(+0.04)	(+0.59)	(+0.01)	(-0.65)
E6B	77	180	+102	-2	-1	+33	-4	-69
			(+0.84)	(-0.03)	(-0.02)	(+0.56)	(-0.05)	(-0.65)
RSF2U1	245	357	+112	-15	-29	+86	+25	-210
			(+0.38)	(-0.06)	(-0.12)	(+0.47)	(+0.11)	(-0.65)
M4	1,469	1,596	+127	-1,063	-1,109	+141	-5	-369
			(+0.08)	(-1.29)	(-1.32)	(+0.43)	(-0.01)	(-0.65)
N1A	14	144	+130	-1	-1	+6	-0	-12
			(+2.30)	(-0.06)	(-0.06)	(+0.53)	(-0.01)	(-0.65)
A10	32	194	+162	-3	+0	+11	-0	-27
			(+1.78)	(-0.09)	(+0.01)	(+0.44)	(-0.01)	(-0.65)
E6A	572	874	+302	-11	-28	+240	-2	-510
			(+0.42)	(-0.02)	(-0.05)	(+0.56)	(-0.00)	(-0.65)
E6C	22	344	+322	-10	-13	+5	-0	-11
			(+2.71)	(-0.60)	(-0.69)	(+0.54)	(-0.02)	(-0.65)
A17	508	846	+338	-77	-9	+145	-6	-392
			(+0.51)	(-0.16)	(-0.02)	(+0.41)	(-0.01)	(-0.65)
A14	3,780	4,152	+372	-915	-475	+987	-37	-2,603
			(+0.09)	(-0.28)	(-0.15)	(+0.42)	(-0.01)	(-0.65)
A5	174	554	+380	-29	-7	+51	-3	-133
			(+1.15)	(-0.18)	(-0.05)	(+0.43)	(-0.02)	(-0.65)
M3	291	1,004	+713	+26	-13	+113	+29	-288
			(+1.24)	(+0.08)	(-0.04)	(+0.44)	(+0.10)	(-0.65)
A7	32	772	+740	+0	+1	+12	+3	-30
			(+3.15)	(+0.01)	(+0.03)	(+0.43)	(+0.08)	(-0.65)
E12	543	1,309	+766	-7	-11	+236	-27	-488
			(+0.88)	(-0.01)	(-0.02)	(+0.58)	(-0.05)	(-0.65)
M1	104	970	+866	-35	-33	+25	+1	-63
			(+2.22)	(-0.41)	(-0.39)	(+0.45)	(+0.02)	(-0.65)
NPP1	26	922	+896	-14	-15	+5	-0	-12
			(+3.53)	(-0.74)	(-0.75)	(+0.49)	(-0.01)	(-0.65)
N1	22	1,212	+1,190	-10	-11	+5	-0	-12
			(+3.97)	(-0.59)	(-0.60)	(+0.50)	(-0.01)	(-0.65)
AB2	788	2,111	+1,324	+90	-41	+310	+192	-798
			(+0.99)	(+0.11)	(-0.05)	(+0.44)	(+0.25)	(-0.65)
N4AB	96	2,083	+1,988	-12	-11	+34	-1	-77
			(+3.07)	(-0.14)	(-0.12)	(+0.52)	(-0.01)	(-0.65)
A3W	1,221	3,954	+2,734	-130	+11	+386	-39	-992
			(+1.17)	(-0.11)	(+0.01)	(+0.44)	(-0.03)	(-0.65)
M2	40	3,700	+3,659	-12	-13	+11	+1	-26
			(+4.49)	(-0.35)	(-0.36)	(+0.45)	(+0.05)	(-0.65)

Divers

Abundance

Across all complexes, there were 128,761 total sightings of diving ducks (sum sightings during the entire survey period). Compared to the previous year, this was a decrease of 98,816 total sightings (-43.4%; Fig. 9). There were on average 10,630 fewer diving ducks detected per survey in fall (Table A2.4), 24,009 fewer detected in winter (Table A2.6), and 14,769 fewer detected in spring (Table A2.8, Fig. 9).

At the pond level, A3W had the highest abundance (mean count of 2,516 per survey), followed by A1 (1,788) and A2W (1,397; Fig. 10). At these sites, we observed the majority of diving ducks roosting on the pond (70.2%), roosting on the pond (85.4%), and roosting on the pond (61.8%), respectively (Table A4.3). Across all six surveys, the sites with the largest increases in diving ducks from last year were AB1 (+543 mean abundance per visit), N2A (+449), and E6B (+221, while the sites with the largest decreases were A8 (-2,148), A14 (-2,142), and E7 (-1,487; Fig. 11). Seasonal abundance of diving ducks was exceptionally low (5th percentile) at AB2 (422 birds in winter). At N2A (3,040 birds in winter), abundance of diving ducks was higher than ever previously recorded there.

Note that the numbers in this section and the next two sections include counts of Ruddy Ducks. We also report trends in Ruddy Ducks as a separate sub-group below.

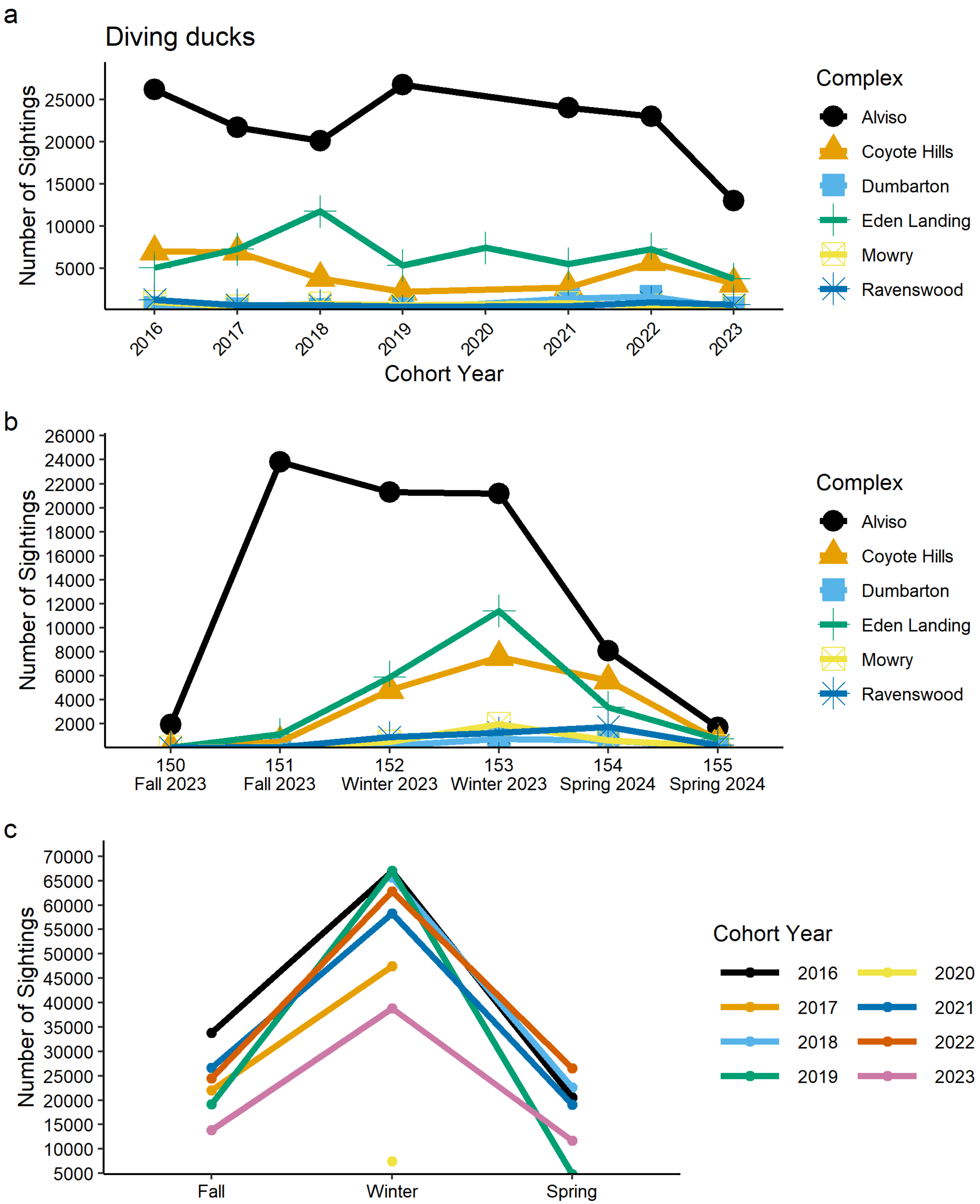

Figure 9. Abundance of diving ducks by (a) study year (September to August of the following year) for each complex (averaged across surveys), (b) survey period for each complex during the current report period (September 2023 – May 2024), and (c) season for each study year at all salt production ponds combined; South San Francisco Bay, California, Sept. 2005 – May 2024 (averaged across surveys). Study years 2019 and 2020 contain incomplete survey rounds.

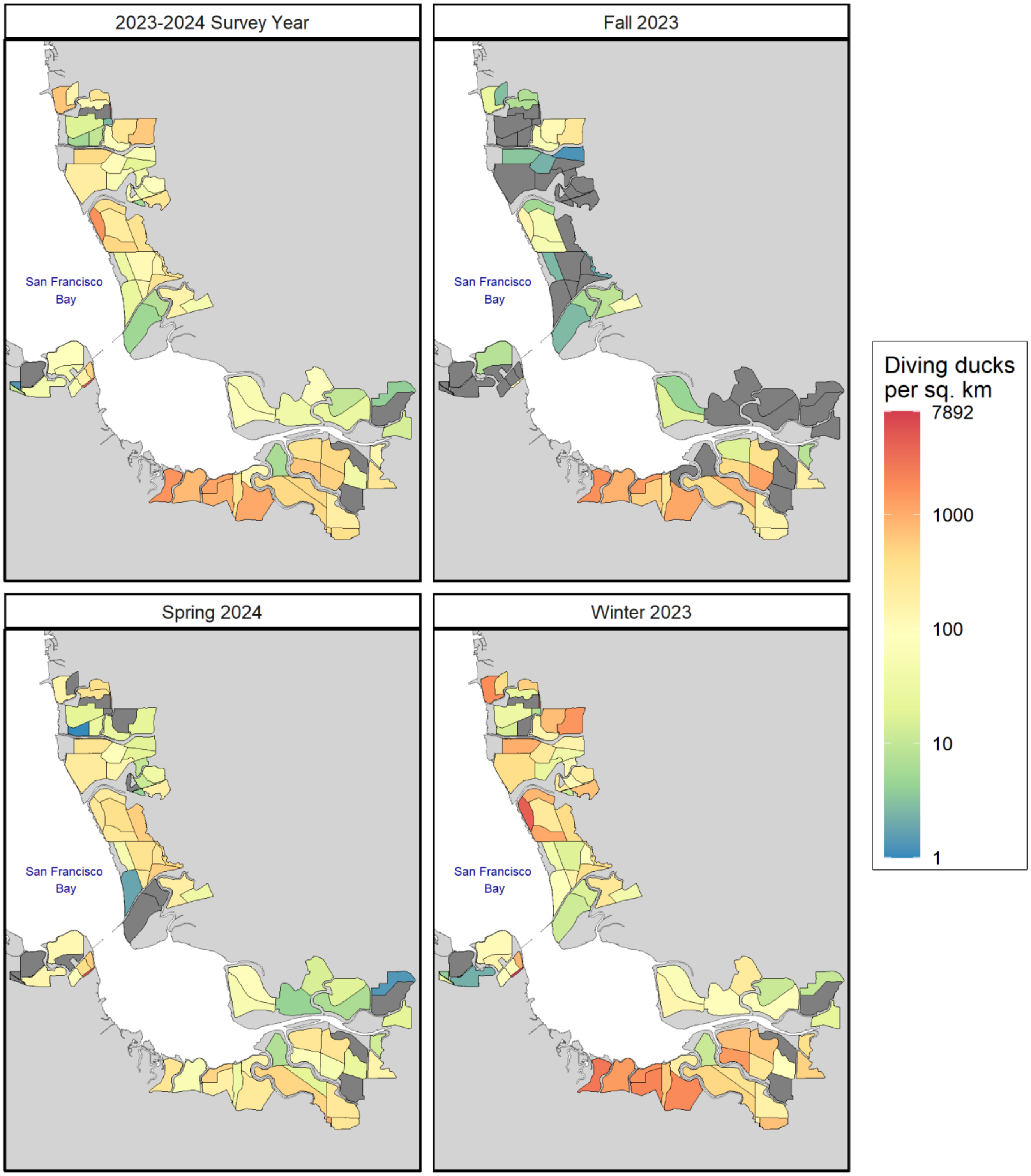

Figure 10. Density of diving ducks averaged across survey rounds by season, South San Francisco Bay, California; September 2023–May 2024. Dark grey ponds had no birds.

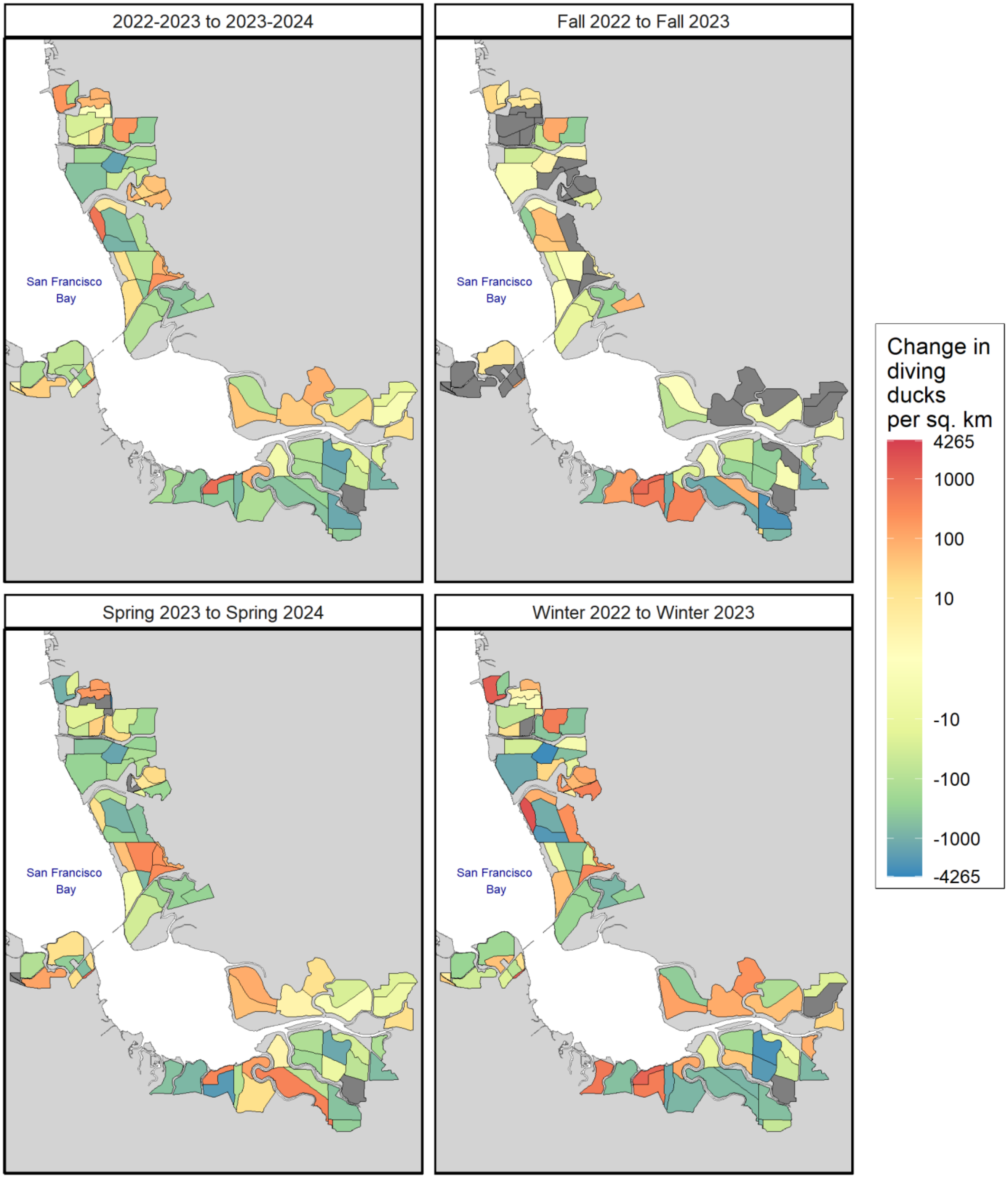

Figure 11. Interannual change in density of diving ducks between September 2022–May 2023 and September 2023–May 2024 in pond habitats of South San Francisco Bay, California. Seasonal panels are density averaged across survey rounds by season, while the Overall panel is averaged across all six survey periods. Dark grey ponds had no birds during that seasonal window in both the current and previous year.

Trends and Trigger Status

For diving ducks in winter, their management trigger—two or more of the past three years of winter abundance below the 2005-2007 baseline value—was not tripped this year because average seasonal abundance was below this threshold in one of the three most recent years of complete surveys (Table 2). The estimated multi-year trend for average winter abundance of diving ducks across the study area was -7,303 at the end of winter 2024. The trend within the SBSPRP-managed wildlife ponds (-244.19 per km^2, -6,775 total) was worse than the trend within the Cargill-managed salt ponds (-6.16 per km^2, -171 total). The trend within SBSPRP ponds that had been breached to restore tidal marsh was better than both the wildlife ponds and salt ponds (-1.02 per km^2, -28 total; Fig. 12).

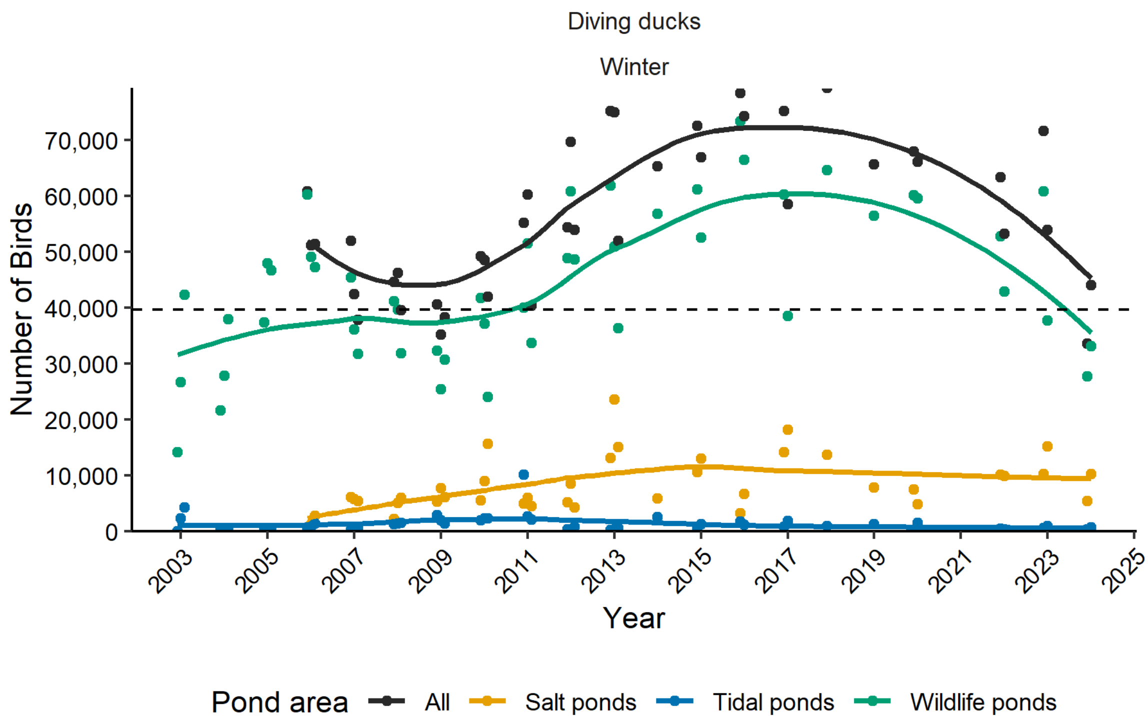

Figure 12. Counts of diving ducks during target season(s) within the South Bay Salt Pond Restoration Project (SBSPRP) and salt production ponds. Lines represent LOESS curves and the dashed lines denote SBSPRP targets or baseline values (average counts from 2005-2007). Ponds A20, A21, A6N, and E10X were excluded from analysis because they were not surveyed after tidal restoration.

Change Model

Change in diving duck abundance was very strongly related to decreases in salinity, and to a lesser degree, precipitation in the focal year (Sept–Feb), with rainier years showing increased abundance (Fig. 13). Less saline ponds were slightly more likely to see population growth, but confidence intervals overlapped zero, echoing previous studies that have found that less saline ponds have higher overall abundance of diving ducks (Scullen et al. 2013, De La Cruz et al. 2018). Surprisingly, an inverse relationship with dissolved oxygen was supported in model selection (Table A5.2), though weak (Fig. 13). This was unexpected because previous reports found abundance was higher in ponds with higher dissolved oxygen (Scullen et al. 2013, De La Cruz et al. 2018). As in dabbling ducks, the base pond characteristics showed little influence on change in abundance. Previous research has also found that diving ducks demonstrated a higher abundance in larger ponds and in ponds with higher staff gauge levels (at the grid level, abundance was highest at 0.33 – 2.51 m deep), while they had lower abundance in breached ponds (De La Cruz et al. 2018).

We report predictions made by the change model within 75 ponds, excluding sites that were unoccupied by diving ducks in winter of both 2024 and 2023 (A12, A23 and E8AE) and sites with missing water quality measurements (A19, A8W and E8AW). Across this set of sites, the actual change in abundance of diving ducks in winter was -23,849. In comparison, the model predicted a total change of -5,076, with this decrease driven by effects of changes in site hydrology. The proportion of variance in percent change in counts explained by the best model was low ($R^2c = 0.19$, $R^2m = 0.18$).

The change model estimated that changes in site hydrology could explain a 5,541 decrease in abundance of diving ducks from last year due to increasing salinity. The sites predicted to experience the largest increase in diving ducks abundance due to hydrology changes were A11, A16, and A3W, while the sites predicted to experience the largest increase in suitability (i.e., predicted percent change irrespective of actual abundance last year) were A22, N8, and E1C (Table 6). The sites predicted to experience the largest negative impacts from changes in hydrology in winter 2024 were A14, A1, and N1 (based on predicted decreases in abundance) and R4, A13, and A15 (based on predicted decrease in suitability). Static site characteristics (distance to bay, number of islands, and pond area) accounted for an increase of 663 birds.

The change model predicted that deviations from mean weather could drive a 665 decrease in abundance due to high precipitation last year, low minimum temperature, and/or high maximum temperature (Table 6). There was also a substantial amount of change in abundance attributable to the unexplained annual variability (the random year effect), with this term in 2024 decreasing abundance by 2,861, some of which is likely due to complex effects of weather not included in the model.

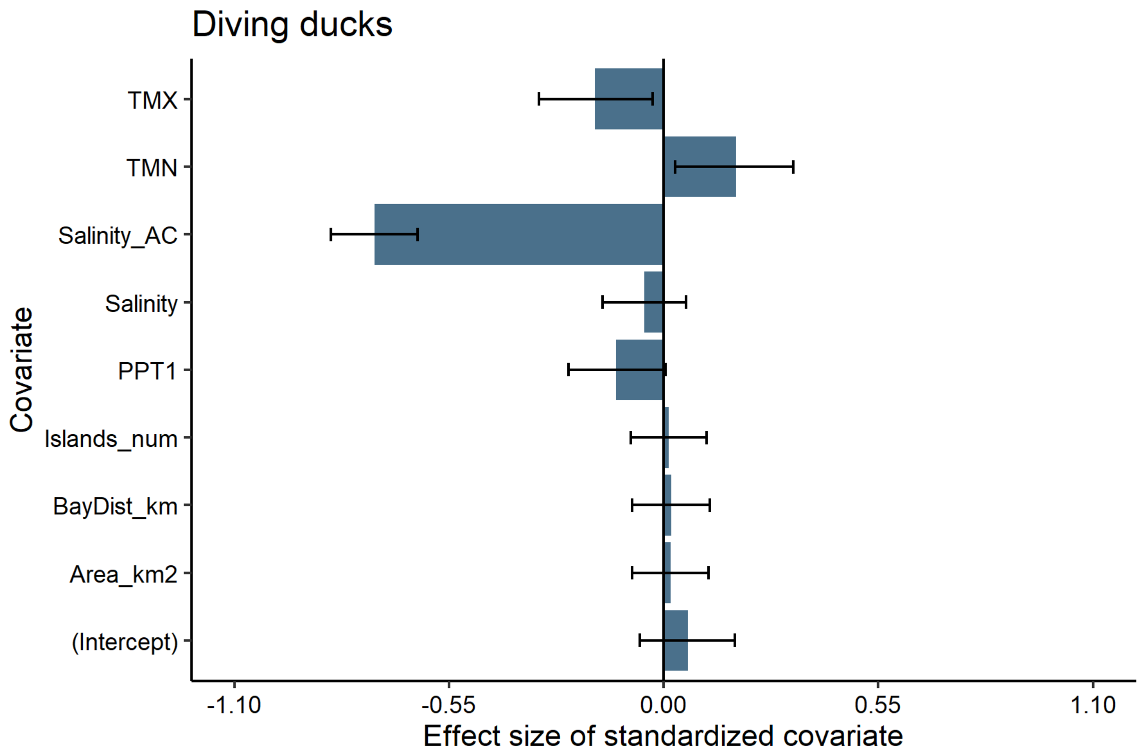

Figure 13. Fixed effects for the top model for interannual change in abundance of diving ducks during winter in current and former salt ponds in South San Francisco Bay, California, water year 2003–2024 (n = 1,302). Dark bars show coefficients and error bars show 95% confidence intervals.

Table 6. Actual and predicted changes in mean abundance per survey of diving ducks from winter 2023 to winter 2024 (sorted greatest decrease to greatest increase). Predicted effect sizes of covariate groups are shown for hydrology (salinity; compared to no change from last year), weather (precipitation last year, minimum temperature, and maximum temperature; compared to mean annual weather), static site characteristics (distance to bay, number of islands, and pond area; compared to mean across all sites), and a year random effect. Change values were calculated by back-transforming the predictions on the ln(% change + 1) scale (shown in parentheses and interpretable as change in relative habitat suitability) and then multiplying by the actual previous year's abundance.

Pond	Previous abun.	Current abun.	Actual change	Predicted change	Hydrology effect	Weather effect	Site effect	Year effect
A14	5,073	928	-4,146	-528	-870	+154	+56	-223
			(-1.70)	(-0.11)	(-0.18)	(+0.03)	(+0.01)	(-0.05)
E2	4,610	1,093	-3,518	-14	+19	-282	+214	-225
			(-1.44)	(-0.00)	(+0.00)	(-0.06)	(+0.05)	(-0.05)
E7	3,412	214	-3,198	-550	-387	-170	+3	-140
			(-2.76)	(-0.18)	(-0.13)	(-0.06)	(+0.00)	(-0.05)
A11	2,662	300	-2,362	+264	+127	+100	+24	-143
			(-2.18)	(+0.09)	(+0.04)	(+0.03)	(+0.01)	(-0.05)
N4AB	3,282	1,056	-2,226	-417	-437	+77	-77	-140
			(-1.13)	(-0.14)	(-0.14)	(+0.03)	(-0.03)	(-0.05)
N3A	2,208	414	-1,794	-182	-238	+37	+1	-99
			(-1.67)	(-0.09)	(-0.11)	(+0.02)	(+0.00)	(-0.05)
A3W	6,173	4,390	-1,782	+201	+73	-83	+151	-312
			(-0.34)	(+0.03)	(+0.01)	(-0.01)	(+0.02)	(-0.05)
A5	2,964	1,199	-1,764	+78	-174	+29	+136	-149
			(-0.90)	(+0.03)	(-0.06)	(+0.01)	(+0.05)	(-0.05)
N1	1,481	365	-1,116	-797	-678	-45	+9	-34
			(-1.40)	(-0.77)	(-0.69)	(-0.06)	(+0.01)	(-0.05)
A2W	3,408	2,432	-977	-190	-227	-39	+26	-158
			(-0.34)	(-0.06)	(-0.07)	(-0.01)	(+0.01)	(-0.05)
A8	1,247	288	-958	+89	-8	+5	+59	-66
			(-1.46)	(+0.07)	(-0.01)	(+0.00)	(+0.04)	(-0.05)
A7	1,248	360	-888	+143	+48	+31	+40	-68
			(-1.24)	(+0.11)	(+0.03)	(+0.02)	(+0.03)	(-0.05)
AB2	1,287	422	-864	-2	-69	+8	+39	-63
			(-1.11)	(-0.00)	(-0.05)	(+0.01)	(+0.03)	(-0.05)
N7	836	26	-810	-250	-197	-37	-0	-29
			(-3.42)	(-0.35)	(-0.29)	(-0.06)	(-0.00)	(-0.05)
M1	858	130	-728	-309	-309	-1	+9	-27
			(-1.88)	(-0.45)	(-0.45)	(-0.00)	(+0.02)	(-0.05)
A16	1,224	508	-716	+203	+79	+42	+68	-70
			(-0.88)	(+0.15)	(+0.06)	(+0.03)	(+0.05)	(-0.05)
E6A	2,601	1,964	-637	-324	-128	-304	+76	-112
			(-0.28)	(-0.13)	(-0.05)	(-0.13)	(+0.03)	(-0.05)
N3	600	28	-572	-114	-121	-2	+17	-24
			(-3.05)	(-0.21)	(-0.22)	(-0.00)	(+0.04)	(-0.05)
E11	767	214	-554	-50	-9	-21	-26	-35
			(-1.28)	(-0.07)	(-0.01)	(-0.03)	(-0.04)	(-0.05)
R1	594	206	-389	+39	+20	+18	-1	-31
			(-1.06)	(+0.06)	(+0.03)	(+0.03)	(-0.00)	(-0.05)
E5	402	27	-375	-47	+8	-38	+0	-17
			(-2.67)	(-0.12)	(+0.02)	(-0.10)	(+0.00)	(-0.05)
E8	473	118	-354	-87	-61	-25	-2	-19
			(-1.38)	(-0.20)	(-0.15)	(-0.06)	(-0.01)	(-0.05)
R4	316	0	-316	-307	-296	+0	-0	-0

Pond	Previous abun.	Current abun.	Actual change	Predicted change	Hydrology effect	Weather effect	Site effect	Year effect
			(-5.76)	(-3.47)	(-3.44)	(+0.00)	(-0.02)	(-0.05)
NPP1	276	33	-242 (-2.10)	-171 (-0.96)	-144 (-0.86)	-8 (-0.07)	+1 (+0.01)	-5 (-0.05)
A9	1,324	1,086	-238 (-0.20)	-10 (-0.01)	-60 (-0.04)	+34 (+0.03)	-2 (-0.00)	-64 (-0.05)
N2	243	13	-230 (-2.86)	-65 (-0.31)	-41 (-0.21)	-12 (-0.07)	-1 (-0.01)	-9 (-0.05)
M5	234	38	-196 (-1.80)	-154 (-1.06)	-158 (-1.07)	+5 (+0.07)	+6 (+0.07)	-4 (-0.05)
N6	206	59	-147 (-1.24)	-13 (-0.06)	+11 (+0.06)	-16 (-0.08)	-7 (-0.04)	-10 (-0.05)
E9	150	48	-102 (-1.12)	-10 (-0.07)	-4 (-0.03)	-8 (-0.05)	+0 (+0.00)	-7 (-0.05)
A22	70	12	-58 (-1.74)	+31 (+0.36)	+27 (+0.31)	+3 (+0.03)	+4 (+0.04)	-5 (-0.05)
E6C	88	40	-48 (-0.78)	-56 (-0.99)	-40 (-0.79)	-4 (-0.12)	-0 (-0.01)	-2 (-0.05)
R3	46	5	-42 (-2.07)	-23 (-0.66)	-21 (-0.62)	+0 (+0.01)	-0 (-0.01)	-1 (-0.05)
E1	1,238	1,198	-40 (-0.03)	-131 (-0.11)	-63 (-0.05)	-73 (-0.06)	-6 (-0.00)	-54 (-0.05)
A8S	521	483	-38 (-0.08)	+13 (+0.02)	-18 (-0.03)	+2 (+0.00)	+15 (+0.03)	-26 (-0.05)
R2	122	88	-34 (-0.33)	-10 (-0.08)	-6 (-0.05)	+4 (+0.04)	-4 (-0.03)	-6 (-0.05)
RSF2U2	62	34	-27 (-0.57)	-1 (-0.02)	-7 (-0.11)	+3 (+0.05)	+2 (+0.03)	-3 (-0.05)
A15	18	0	-18 (-2.94)	-16 (-1.71)	-15 (-1.67)	+0 (+0.03)	+0 (+0.01)	-0 (-0.05)
RSF2U3	86	70	-16 (-0.20)	-60 (-1.16)	-58 (-1.14)	+1 (+0.05)	-1 (-0.04)	-1 (-0.05)
N8	53	44	-9 (-0.18)	+6 (+0.11)	+12 (+0.21)	-5 (-0.08)	-1 (-0.02)	-3 (-0.05)
N5	36	32	-4 (-0.13)	-9 (-0.27)	-9 (-0.27)	+1 (+0.04)	-1 (-0.03)	-1 (-0.05)
E6	126	124	-2 (-0.02)	-27 (-0.24)	-13 (-0.12)	-12 (-0.12)	+1 (+0.01)	-5 (-0.05)
E14	1	0	-1 (-0.69)	-0 (-0.05)	-0 (-0.02)	-0 (-0.02)	-0 (-0.02)	-0 (-0.05)
A6S	26	26	0 (0.00)	+0 (+0.01)	-0 (-0.01)	+0 (+0.02)	-0 (-0.02)	-1 (-0.05)
E13	14	16	+1 (+0.06)	-1 (-0.08)	-1 (-0.04)	-0 (-0.02)	-0 (-0.02)	-1 (-0.05)
E2C	2	3	+1 (+0.29)	-1 (-0.20)	-0 (-0.07)	-0 (-0.12)	-0 (-0.02)	-0 (-0.05)
R5	0	1	+1 (+0.69)	-0 (-0.31)	-0 (-0.28)	-0 (-0.00)	-0 (-0.04)	-0 (-0.05)
RSF2U1	198	200	+2 (+0.01)	-18 (-0.10)	-26 (-0.13)	+8 (+0.05)	-4 (-0.02)	-9 (-0.05)
RS5	1	8	+7 (+1.50)	-0 (-0.18)	-0 (-0.15)	-0 (-0.00)	-0 (-0.04)	-0 (-0.05)
E4	4	20	+16 (+1.46)	-1 (-0.33)	-1 (-0.27)	-0 (-0.05)	+0 (+0.00)	-0 (-0.05)
E5C	22	44	+22 (+0.69)	-4 (-0.20)	-1 (-0.06)	-2 (-0.12)	-0 (-0.01)	-1 (-0.05)

Pond	Previous abun.	Current abun.	Actual change	Predicted change	Hydrology effect	Weather effect	Site effect	Year effect
E12	209	236	+28 (+0.12)	-13 (-0.06)	-5 (-0.02)	-5 (-0.03)	-4 (-0.02)	-10 (-0.05)
A10	1,418	1,460	+42 (+0.03)	+59 (+0.04)	+19 (+0.01)	+39 (+0.03)	-12 (-0.01)	-72 (-0.05)
N4B	52	94	+42 (+0.58)	-12 (-0.26)	-7 (-0.16)	-4 (-0.08)	-1 (-0.02)	-2 (-0.05)
A17	160	206	+46 (+0.25)	+7 (+0.04)	-4 (-0.02)	+5 (+0.03)	+2 (+0.01)	-8 (-0.05)
A13	146	192	+46 (+0.27)	-119 (-1.66)	-121 (-1.67)	+1 (+0.04)	+1 (+0.03)	-1 (-0.05)
E1C	10	63	+53 (+1.76)	+0 (+0.00)	+1 (+0.11)	-1 (-0.07)	-0 (-0.02)	-1 (-0.05)
N1A	509	566	+58 (+0.11)	-67 (-0.14)	-34 (-0.07)	-22 (-0.05)	-11 (-0.03)	-22 (-0.05)
N4	32	101	+69 (+1.13)	-6 (-0.21)	-6 (-0.20)	+0 (+0.02)	-0 (-0.02)	-1 (-0.05)
A3N	64	136	+72 (+0.75)	+1 (+0.02)	+3 (+0.04)	+1 (+0.02)	-3 (-0.04)	-3 (-0.05)
E4C	74	154	+81 (+0.74)	-3 (-0.04)	+6 (+0.09)	-9 (-0.12)	+2 (+0.03)	-4 (-0.05)
RSF2U4	396	494	+98 (+0.22)	-33 (-0.09)	-35 (-0.09)	+18 (+0.05)	-21 (-0.06)	-18 (-0.05)
E8X	132	239	+108 (+0.59)	-11 (-0.09)	-4 (-0.03)	-5 (-0.04)	-3 (-0.03)	-6 (-0.05)
N9	40	222	+182 (+1.69)	-7 (-0.19)	-3 (-0.09)	-3 (-0.08)	-1 (-0.02)	-2 (-0.05)
M3	14	223	+209 (+2.70)	-0 (-0.03)	-1 (-0.05)	+0 (+0.03)	+1 (+0.06)	-1 (-0.05)
M2	22	282	+261 (+2.53)	-8 (-0.41)	-8 (-0.41)	+0 (+0.01)	+0 (+0.02)	-1 (-0.05)
E3C	171	448	+277 (+0.96)	-33 (-0.21)	-18 (-0.12)	-17 (-0.12)	+2 (+0.02)	-7 (-0.05)
M4	64	342	+278 (+1.67)	-50 (-1.51)	-50 (-1.50)	+0 (+0.03)	+1 (+0.07)	-1 (-0.05)
N4AA	227	516	+288 (+0.82)	-39 (-0.19)	-25 (-0.12)	-14 (-0.07)	-0 (-0.00)	-9 (-0.05)
E6B	284	850	+566 (+1.09)	-18 (-0.06)	-5 (-0.02)	-18 (-0.07)	+3 (+0.01)	-13 (-0.05)
A2E	2,096	2,738	+642 (+0.27)	+41 (+0.02)	+55 (+0.03)	-4 (-0.00)	-30 (-0.01)	-105 (-0.05)
A1	2,464	3,128	+664 (+0.24)	-737 (-0.36)	-715 (-0.35)	-23 (-0.01)	-19 (-0.01)	-85 (-0.05)
AB1	270	1,042	+772 (+1.35)	+1 (+0.00)	+4 (+0.02)	+3 (+0.01)	-10 (-0.04)	-13 (-0.05)
M6	18	827	+809 (+3.77)	-3 (-0.17)	-2 (-0.14)	+1 (+0.09)	+0 (+0.02)	-1 (-0.05)
E10	166	1,534	+1,369 (+2.22)	+9 (+0.05)	+8 (+0.05)	+4 (+0.02)	-4 (-0.02)	-9 (-0.05)
N2A	1,462	3,040	+1,578 (+0.73)	-156 (-0.11)	-126 (-0.09)	+15 (+0.01)	-51 (-0.04)	-64 (-0.05)

Ruddy Duck

Abundance

Across all complexes, there were 78,704 total sightings of Ruddy Ducks (sum sightings during the entire survey period). Compared to the previous year, this was a decrease of 45,094 total sightings (-36.4%; Fig. 14). There were on average 3,718 fewer Ruddy Ducks detected per survey in fall (Table A2.4), 8,706 fewer detected in winter (Table A2.6), and 10,122 fewer detected in spring (Table A2.8, Fig. 14).

At the pond level, A3W had the highest abundance (mean count of 2,286 per survey), followed by A2E (1,157) and A1 (900; Fig. 15). At these sites, we observed the majority of Ruddy Ducks roosting on the pond (73.6%), roosting on the pond (89.3%), and roosting on the pond (95.6%), respectively (Table A4.4). Across all six surveys, the sites with the largest increases in Ruddy Ducks from last year were AB1 (+622 mean abundance per visit), N2A (+395), and E6B (+227, while the sites with the largest decreases were E7 (-1,524), N3A (-888), and E2 (-813; Fig. 16). Seasonal abundance of Ruddy Ducks was exceptionally low (5th percentile) at AB2 (326 birds in winter). At RSF2U4 (441 birds in winter), abundance of Ruddy Ducks was higher than ever previously recorded there.

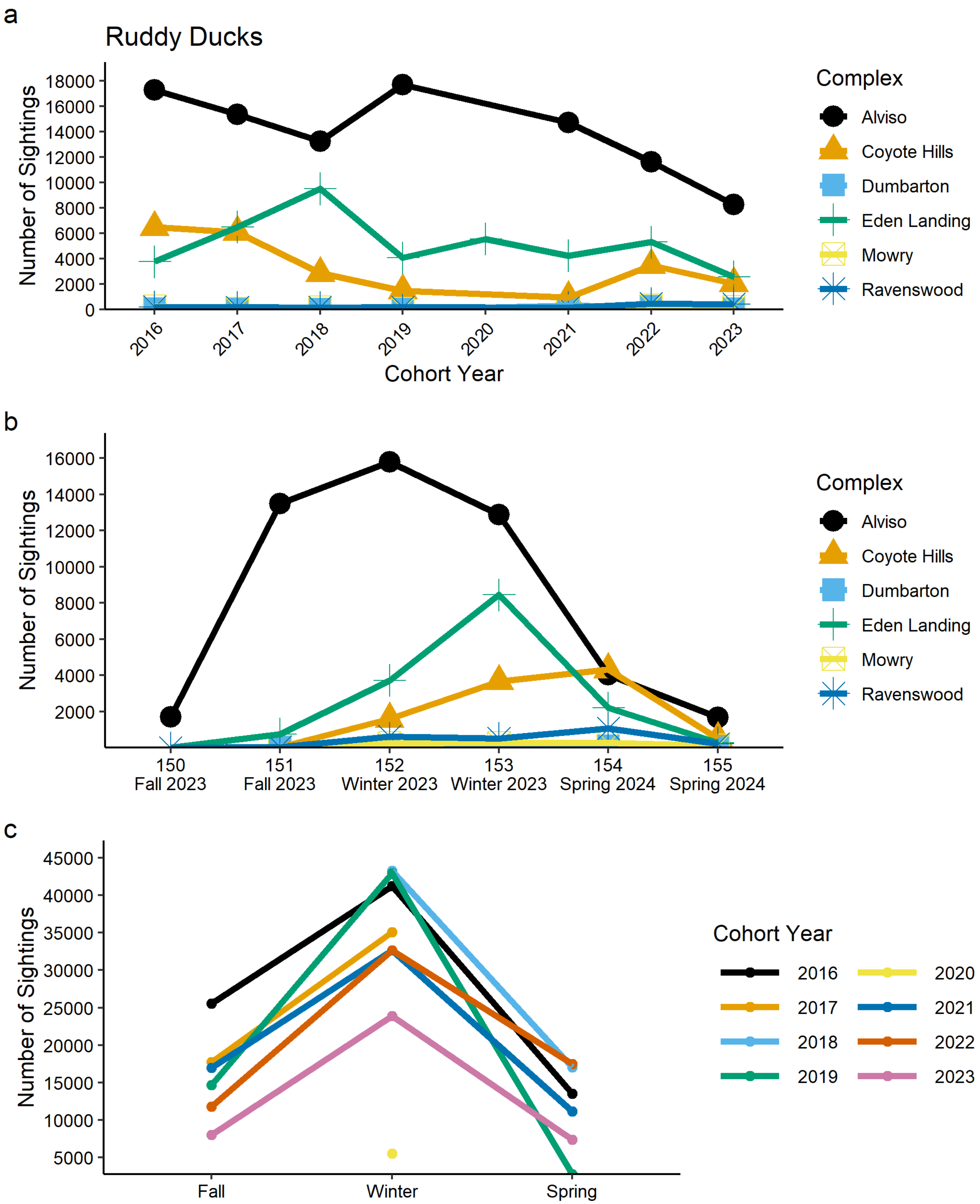

Figure 14. Abundance of Ruddy Ducks by (a) study year (September to August of the following year) for each complex (averaged across surveys), (b) survey period for each complex during the current report period (September 2023 – May 2024), and (c) season for each study year at all salt production ponds combined; South San Francisco Bay, California, Sept. 2005 – May 2024 (averaged across surveys). Study years 2019 and 2020 contain incomplete survey rounds.

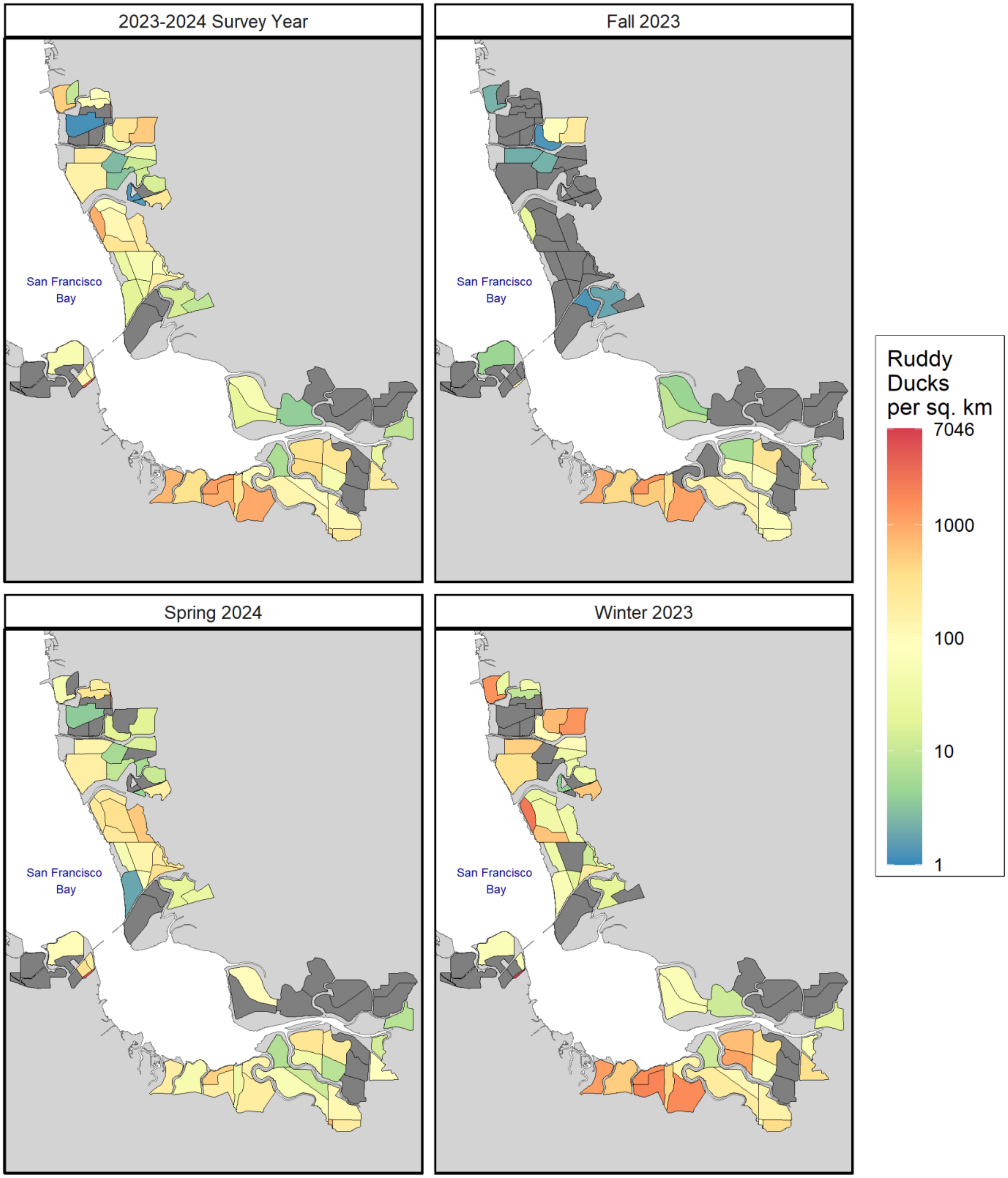

Figure 15. Density of Ruddy Ducks averaged across survey rounds by season, South San Francisco Bay, California; September 2023–May 2024. Dark grey ponds had no birds.

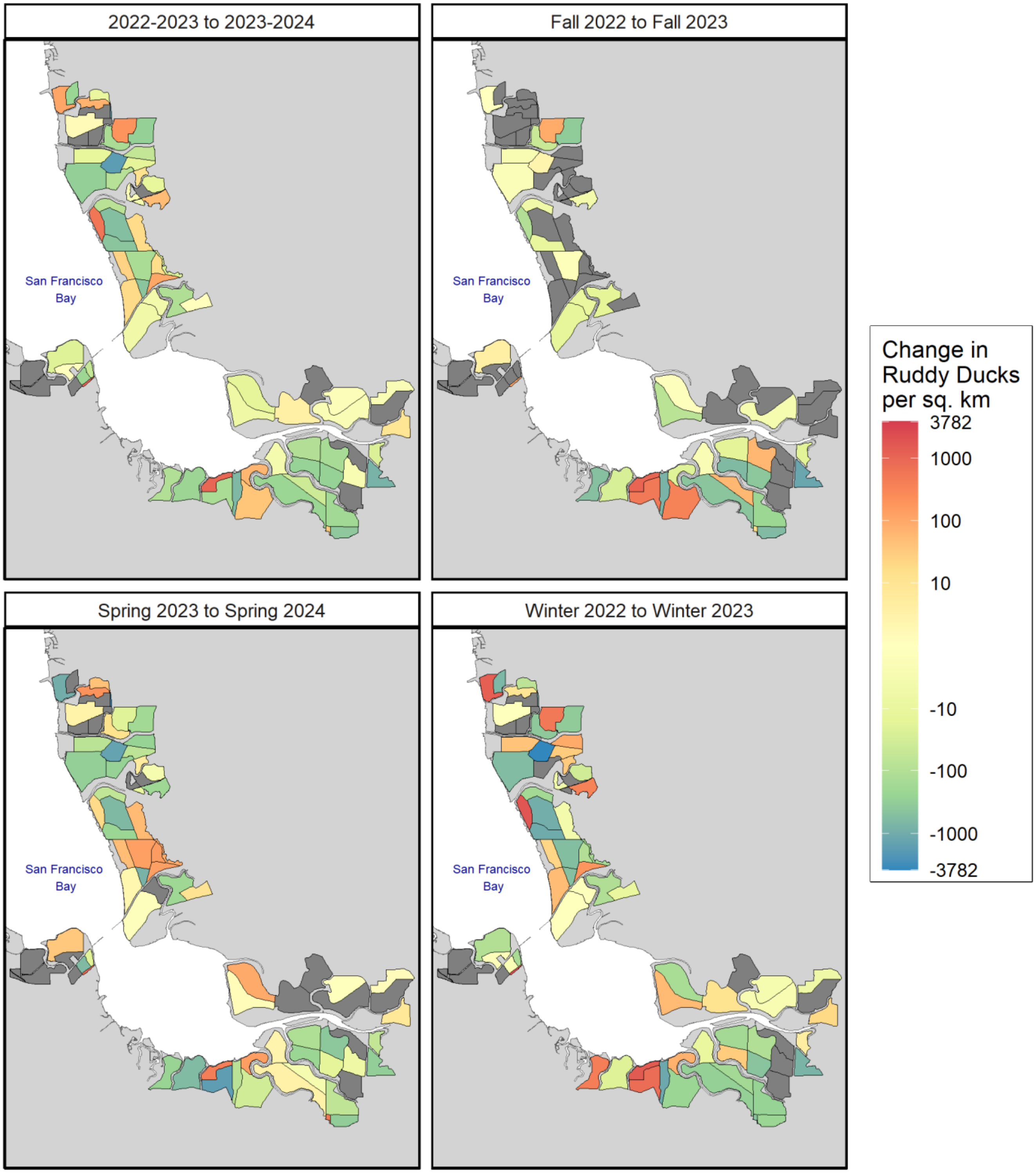

Figure 16. Interannual change in density of Ruddy Ducks between September 2022–May 2023 and September 2023–May 2024 in pond habitats of South San Francisco Bay, California. Seasonal panels are density averaged across survey rounds by season, while the Overall panel is averaged across all six survey periods. Dark grey ponds had no birds during that seasonal window in both the current and previous year.

Trends and Trigger Status

For Ruddy Ducks in winter, their management trigger—two or more of the past three years of winter abundance below the 2005-2007 baseline value—was not tripped this year because average seasonal abundance was below this threshold in none of the three most recent years of complete surveys (Table 2). The estimated multi-year trend for average winter abundance of Ruddy Ducks across the study area was -6,328 at the end of winter 2024. The trend within the SBSPRP-managed wildlife ponds (-189.93 per km^2, -5,269 total) was worse than the trend within the Cargill-managed salt ponds (-34.25 per km^2, -950 total). The trend within SBSPRP ponds that had been breached to restore tidal marsh was better than both the wildlife ponds and salt ponds (+4.45 per km^2, +124 total; Fig. 17).

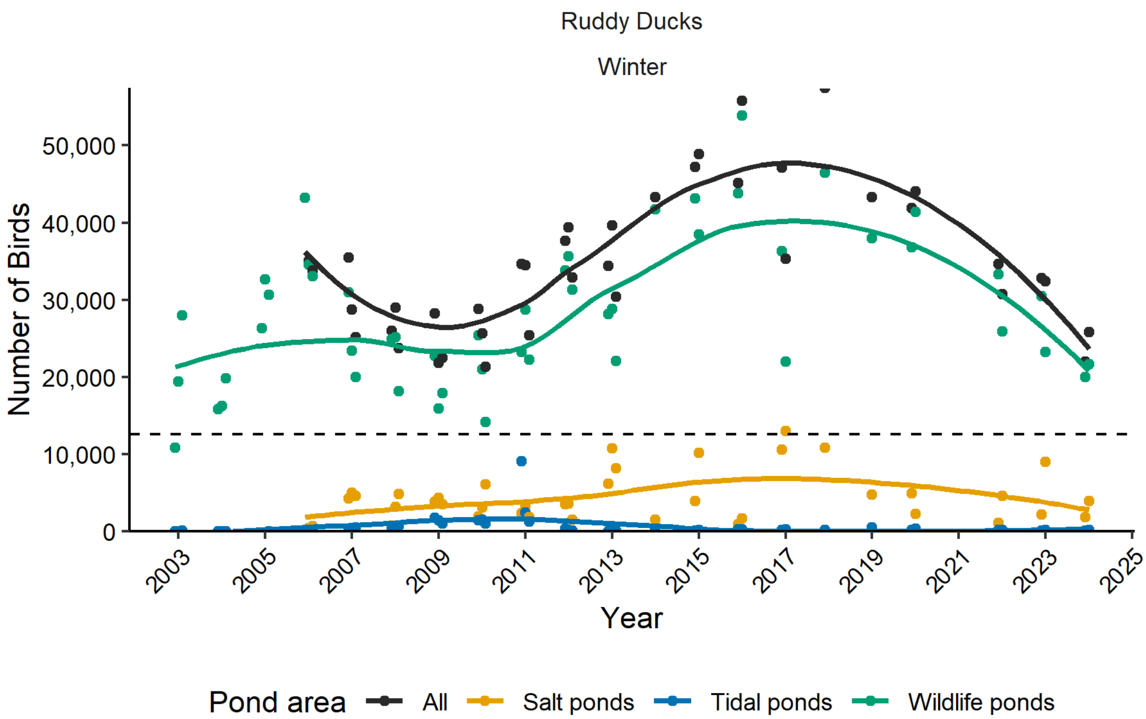

Figure 17. Counts of Ruddy Ducks during target season(s) within the South Bay Salt Pond Restoration Project (SBSPRP) and salt production ponds. Lines represent LOESS curves and the dashed lines denote SBSPRP targets or baseline values (average counts from 2005-2007). Ponds A20, A21, A6N, and E10X were excluded from analysis because they were not surveyed after tidal restoration.

Change Model

The best change model for Ruddy Ducks differed from the best change model for diving ducks. Decreasing salinity, decreasing pH, and increasing dissolved oxygen all very strongly predicted increases in abundance (Fig. 18). Model selection supported that Ruddy Duck population growth was higher as water depth in ponds increased (Table A5.num.table.aic), which is in line with expectations for a species of diving duck; however confidence intervals overlapped zero (Fig. 18). Increases were also more commonly in years with greater fall through winter precipitation (Fig. 18). Like dabbling and diving ducks, base site characteristics did not strongly predict percent changes in abundance.

We report predictions made by the change model within 63 ponds, excluding sites that were unoccupied by Ruddy Ducks in winter of both 2024 and 2023 (A12, A13, A15, A23, E14, E2C, E4, E5C, E8AE, E8AW, M6, R3, R4, R5, RS5 and RSF2U3) and sites with missing water quality measurements (A19 and A8W). Across this set of sites, the actual change in abundance of Ruddy Ducks in winter was -11,707. In comparison, the model predicted a total change of -7,923, with this decrease driven by effects of changes in site hydrology. The proportion of variance in percent change in counts explained by the best model was low ($R^2c = 0.15$, $R^2m = 0.11$).

The change model estimated that changes in site hydrology could explain a 7,123 decrease in abundance of Ruddy Ducks from last year due to decreasing dissolved oxygen, increasing pH, increasing salinity, and/or decreasing depth. The sites predicted to experience the largest increase in Ruddy Ducks abundance due to hydrology changes were A3W, A16, and E10, while the sites predicted to experience the largest increase in suitability (i.e., predicted percent change irrespective of actual abundance last year) were N8, A3N, and E10 (Table 7). The sites predicted to experience the largest negative impacts from changes in hydrology in winter 2024 were E7, E2, and A9 (based on predicted decreases in abundance) and E7, E6C, and M1 (based on predicted decrease in suitability). Static site characteristics (distance to bay, number of islands, and pond area) accounted for a decrease of 736 birds.

Weather was not a significant variable, but there was also a substantial amount of change in abundance attributable to the unexplained annual variability (the random year effect). This term in 2024 increased abundance by 280, some of which is likely due to complex effects of weather not included in the model.

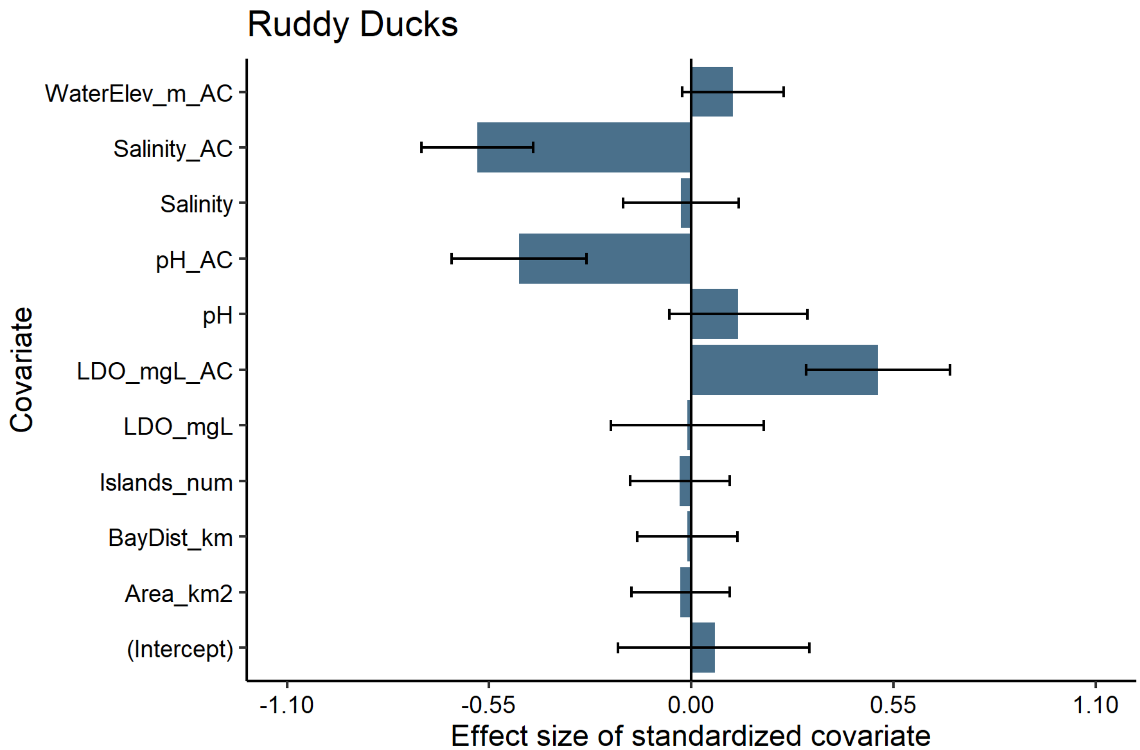

Figure 18. Fixed effects for the top model for interannual change in abundance of Ruddy Ducks during winter in current and former salt ponds in South San Francisco Bay, California, water year 2003–2024 (n = 1,079). Dark bars show coefficients and error bars show 95% confidence intervals.

Table 7. Actual and predicted changes in mean abundance per survey of Ruddy Ducks from winter 2023 to winter 2024 (sorted greatest decrease to greatest increase). Predicted effect sizes of covariate groups are shown for hydrology (dissolved oxygen, pH, salinity, and depth; compared to no change from last year), static site characteristics (distance to bay, number of islands, and pond area; compared to mean across all sites), and a year random effect. Change values were calculated by back-transforming the predictions on the ln(% change + 1) scale (shown in parentheses and interpretable as change in relative habitat suitability) and then multiplying by the actual previous year's abundance.

Pond	**Previous abun.**	**Current abun.**	**Actual change**	**Predicted change**	**Hydrology effect**	**Site effect**	**Year effect**
E2	4,891	848	-4,044 (-1.75)	-3,034 (-0.97)	-2,549 (-0.86)	-220 (-0.11)	+19 (+0.01)
E7	3,340	0	-3,340 (-8.11)	-3,036 (-2.40)	-2,734 (-2.30)	+1 (+0.00)	+3 (+0.01)
N3A	1,645	124	-1,521 (-2.58)	+434 (+0.23)	+343 (+0.18)	-18 (-0.01)	+21 (+0.01)
N4AB	1,584	596	-988 (-0.98)	-986 (-0.97)	-596 (-0.69)	+18 (+0.03)	+6 (+0.01)
N7	832	0	-832 (-6.73)	-584 (-1.21)	-565 (-1.18)	-1 (-0.00)	+2 (+0.01)
AB2	1,152	326	-826 (-1.26)	-115 (-0.10)	-103 (-0.09)	-127 (-0.12)	+10 (+0.01)
A16	1,110	350	-761 (-1.15)	+400 (+0.31)	+459 (+0.36)	-76 (-0.05)	+15 (+0.01)
A5	1,282	546	-735 (-0.85)	-325 (-0.29)	-448 (-0.38)	-70 (-0.07)	+10 (+0.01)
E11	737	30	-707 (-3.17)	-152 (-0.23)	-146 (-0.22)	+28 (+0.05)	+6 (+0.01)
A3W	4,342	3,826	-516 (-0.13)	+2,875 (+0.51)	+2,818 (+0.50)	-308 (-0.04)	+72 (+0.01)
A11	534	62	-472 (-2.14)	-160 (-0.36)	-115 (-0.27)	+3 (+0.01)	+4 (+0.01)
E6A	2,266	1,824	-442 (-0.22)	-264 (-0.12)	-296 (-0.14)	-59 (-0.03)	+20 (+0.01)
A8	698	258	-439 (-0.99)	-149 (-0.24)	-134 (-0.22)	-18 (-0.03)	+6 (+0.01)
E8	358	76	-282 (-1.54)	-11 (-0.03)	-19 (-0.05)	+8 (+0.02)	+3 (+0.01)
M1	400	120	-280 (-1.19)	-290 (-1.28)	-277 (-1.25)	-5 (-0.04)	+1 (+0.01)
A9	1,309	1,047	-262 (-0.22)	-620 (-0.64)	-872 (-0.82)	-1 (-0.00)	+7 (+0.01)
A7	316	128	-188 (-0.90)	-191 (-0.92)	-210 (-0.98)	-7 (-0.05)	+1 (+0.01)
N6	198	15	-183 (-2.52)	+190 (+0.67)	+198 (+0.71)	+21 (+0.05)	+4 (+0.01)
R1	294	112	-183 (-0.97)	-102 (-0.43)	-89 (-0.38)	-2 (-0.01)	+2 (+0.01)

Pond	Previous abun.	Current abun.	Actual change	Predicted change	Hydrology effect	Site effect	Year effect
N1	180	27	-152	-135	-112	-0	+0
			(-1.86)	(-1.39)	(-1.25)	(-0.01)	(+0.01)
A14	582	431	-152	-314	-265	-2	+3
			(-0.30)	(-0.77)	(-0.68)	(-0.01)	(+0.01)
A8S	417	266	-152	-101	-188	+3	+3
			(-0.45)	(-0.28)	(-0.47)	(+0.01)	(+0.01)
N1A	132	18	-114	-45	-36	+3	+1
			(-1.94)	(-0.42)	(-0.34)	(+0.04)	(+0.01)
N4AA	94	42	-52	-18	-22	+1	+1
			(-0.78)	(-0.20)	(-0.25)	(+0.01)	(+0.01)
N8	52	11	-42	+61	+65	+5	+1
			(-1.49)	(+0.76)	(+0.84)	(+0.04)	(+0.01)
A2W	968	934	-35	-404	-323	-21	+6
			(-0.04)	(-0.54)	(-0.45)	(-0.04)	(+0.01)
E8X	112	79	-32	-15	-2	+5	+1
			(-0.34)	(-0.14)	(-0.02)	(+0.06)	(+0.01)
E12	50	18	-32	-3	-2	+2	+0
			(-0.96)	(-0.06)	(-0.04)	(+0.04)	(+0.01)
N4B	50	20	-30	-27	-35	+1	+0
			(-0.90)	(-0.76)	(-0.90)	(+0.05)	(+0.01)
RSF2U1	46	29	-18	-14	-18	-0	+0
			(-0.46)	(-0.35)	(-0.42)	(-0.00)	(+0.01)
NPP1	16	0	-16	-12	-11	+0	+0
			(-2.83)	(-1.32)	(-1.21)	(+0.02)	(+0.01)
A22	13	0	-13	-1	-1	-0	+0
			(-2.64)	(-0.06)	(-0.07)	(-0.01)	(+0.01)
M5	4	0	-4	-4	-3	-0	+0
			(-1.70)	(-1.33)	(-1.02)	(-0.08)	(+0.01)
M4	6	3	-2	-5	-4	-0	+0
			(-0.49)	(-1.49)	(-1.25)	(-0.06)	(+0.01)
E1C	4	2	-2	-1	-2	+0	+0
			(-0.51)	(-0.33)	(-0.37)	(+0.05)	(+0.01)
E9	1	0	-1	-1	-1	-0	+0
			(-0.69)	(-1.25)	(-0.83)	(-0.02)	(+0.01)
N2	1	0	-1	-1	-1	+0	+0
			(-0.69)	(-0.34)	(-0.32)	(+0.00)	(+0.01)
N3	1	0	-1	-1	-1	-0	+0
			(-0.69)	(-0.57)	(-0.46)	(-0.10)	(+0.01)
R2	1	0	-1	-1	-1	+0	+0
			(-0.69)	(-0.49)	(-0.47)	(+0.05)	(+0.01)
RSF2U2	1	0	-1	-1	-1	-0	+0
			(-0.69)	(-0.75)	(-0.59)	(-0.14)	(+0.01)
E4C	48	47	-0	-20	-21	-1	+0
			(-0.01)	(-0.53)	(-0.56)	(-0.03)	(+0.01)
A6S	24	26	+2	-5	-4	+0	+0

Pond	Previous abun.	Current abun.	Actual change	Predicted change	Hydrology effect	Site effect	Year effect
			(+0.08)	(-0.22)	(-0.19)	(+0.02)	(+0.01)
A17	28	31	+2	-7	-3	+0	+0
			(+0.08)	(-0.28)	(-0.11)	(+0.02)	(+0.01)
E13	0	6	+6	-0	-0	+0	+0
			(+1.87)	(-0.13)	(-0.10)	(+0.04)	(+0.01)
N5	21	28	+6	-15	-16	+0	+0
			(+0.26)	(-1.17)	(-1.23)	(+0.04)	(+0.01)
E6C	1	23	+22	-2	-2	+0	+0
			(+2.48)	(-1.57)	(-1.56)	(+0.04)	(+0.01)
M3	2	26	+24	-0	+0	-0	+0
			(+2.18)	(-0.06)	(+0.18)	(-0.11)	(+0.01)
A10	1,075	1,107	+32	+119	+21	+21	+12
			(+0.03)	(+0.11)	(+0.02)	(+0.02)	(+0.01)
E5	2	44	+42	-1	-1	+0	+0
			(+2.71)	(-0.38)	(-0.44)	(+0.02)	(+0.01)
E1	543	593	+50	-42	+52	+2	+5
			(+0.09)	(-0.08)	(+0.11)	(+0.00)	(+0.01)
A3N	47	98	+50	+83	+74	+6	+1
			(+0.72)	(+1.00)	(+0.82)	(+0.05)	(+0.01)
E6	7	78	+71	-4	-6	+0	+0
			(+2.29)	(-0.67)	(-0.86)	(+0.01)	(+0.01)
N4	2	75	+73	-1	-1	+0	+0
			(+3.23)	(-0.49)	(-0.53)	(+0.01)	(+0.01)
N9	34	118	+84	-18	-18	+1	+0
			(+1.22)	(-0.71)	(-0.72)	(+0.04)	(+0.01)
E3C	276	384	+108	-140	-167	-2	+1
			(+0.33)	(-0.70)	(-0.80)	(-0.01)	(+0.01)
M2	1	112	+112	-1	-1	-0	+0
			(+4.04)	(-0.91)	(-0.87)	(-0.05)	(+0.01)
RSF2U4	290	441	+150	+307	+316	+43	+6
			(+0.42)	(+0.72)	(+0.75)	(+0.08)	(+0.01)
A1	873	1,362	+489	-634	-554	+0	+2
			(+0.44)	(-1.29)	(-1.20)	(+0.00)	(+0.01)
E6B	228	829	+600	-120	-107	+0	+1
			(+1.29)	(-0.74)	(-0.68)	(+0.00)	(+0.01)
AB1	66	1,006	+939	-18	-23	+2	+0
			(+2.70)	(-0.30)	(-0.38)	(+0.04)	(+0.01)
E10	291	1,277	+986	+401	+377	+6	+7
			(+1.48)	(+0.86)	(+0.79)	(+0.01)	(+0.01)
A2E	1,476	2,530	+1,054	-473	-637	+12	+10
			(+0.54)	(-0.39)	(-0.49)	(+0.01)	(+0.01)
N2A	427	1,670	+1,242	-167	-106	+12	+3
			(+1.36)	(-0.50)	(-0.34)	(+0.05)	(+0.01)

Eared Grebes

Abundance

Across all complexes, there were 27,310 total sightings of Eared Grebes (sum sightings during the entire survey period). Compared to the previous year, this was a decrease of 22,199 total sightings (-44.8%; Fig. 19). There were on average 118 more Eared Grebes detected per survey in fall (Table A2.4), 3,938 fewer detected in winter (Table A2.6), and 7,279 fewer detected in spring (Table A2.8, Fig. 19).

At the pond level, M3 had the highest abundance (mean count of 1,420 per survey), followed by M1 (814) and M4 (798; Fig. 20). At these sites, we observed the majority of Eared Grebes foraging (80.9%), foraging (66.5%), and foraging (67.2%), respectively (Table A4.5). Across all six surveys, the sites with the largest increases in Eared Grebes from last year were M1 (+790 mean abundance per visit), M2 (+682), and A8 (+86, while the sites with the largest decreases were M4 (-2,404), M5 (-1,294), and M6 (-1,009; Fig. 21). Seasonal abundance of Eared Grebes was exceptionally low (5th percentile) at A15 (0 birds in spring), A15 (0 in winter), N2 (0 in winter), and N3 (0 in winter). At M2 (1,056 birds in winter), abundance of Eared Grebes was higher than ever previously recorded there.

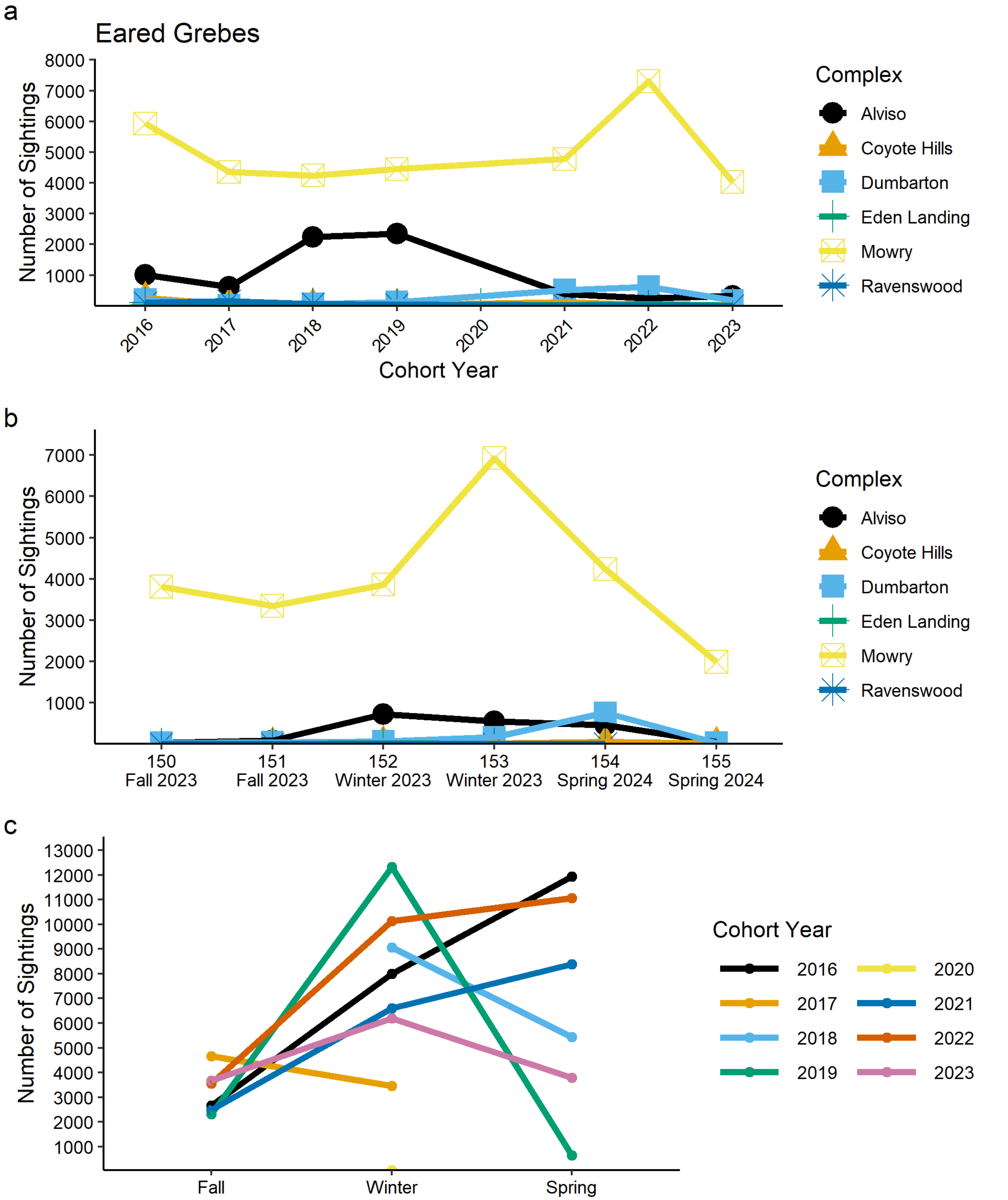

Figure 19. Abundance of Eared Grebes by (a) study year (September to August of the following year) for each complex (averaged across surveys), (b) survey period for each complex during the current report period (September 2023 – May 2024), and (c) season for each study year at all salt production ponds combined; South San Francisco Bay, California, Sept. 2005 – May 2024 (averaged across surveys). Study years 2019 and 2020 contain incomplete survey rounds.

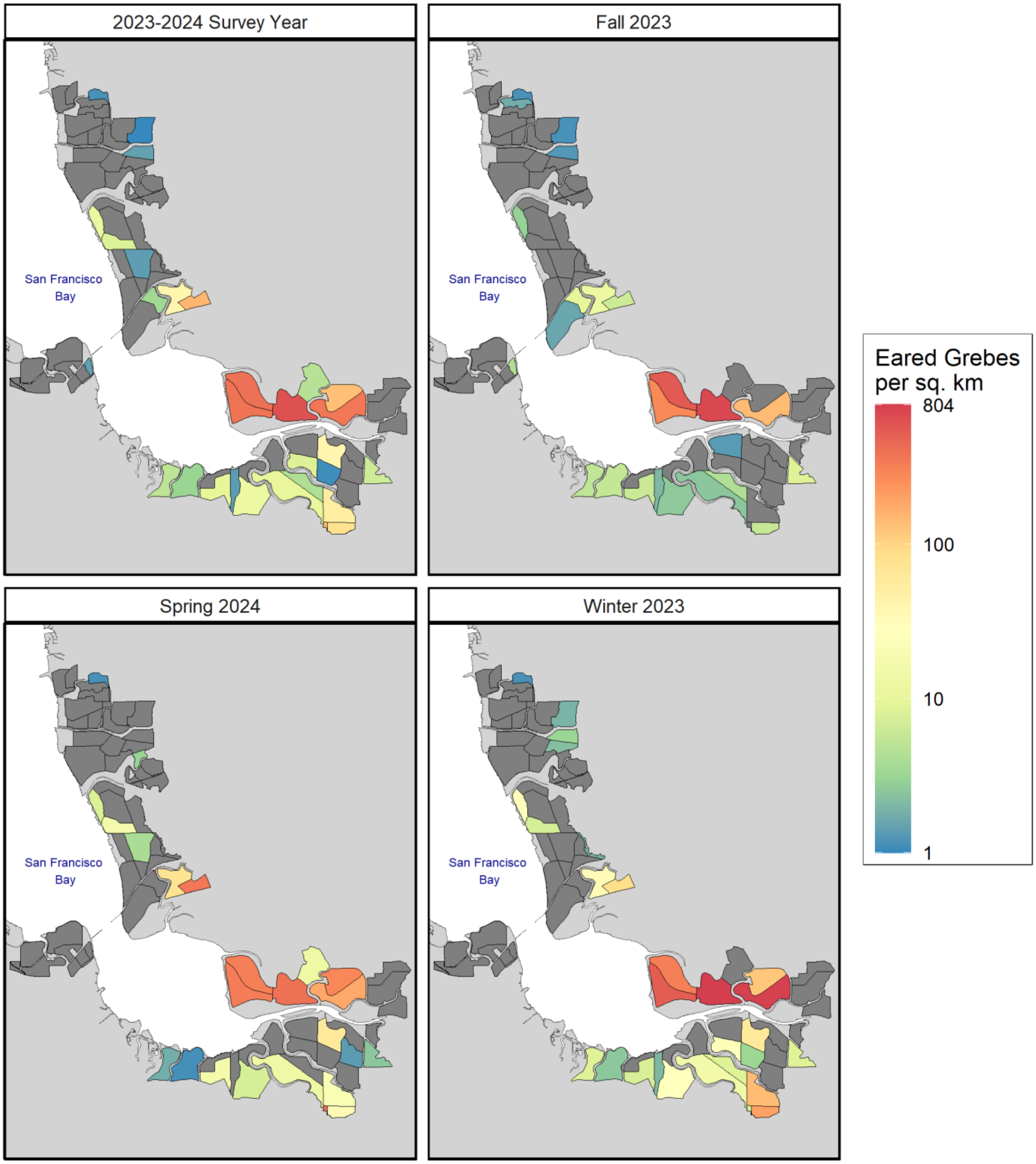

Figure 20. Density of Eared Grebes averaged across survey rounds by season, South San Francisco Bay, California; September 2023–May 2024. Dark grey ponds had no birds.

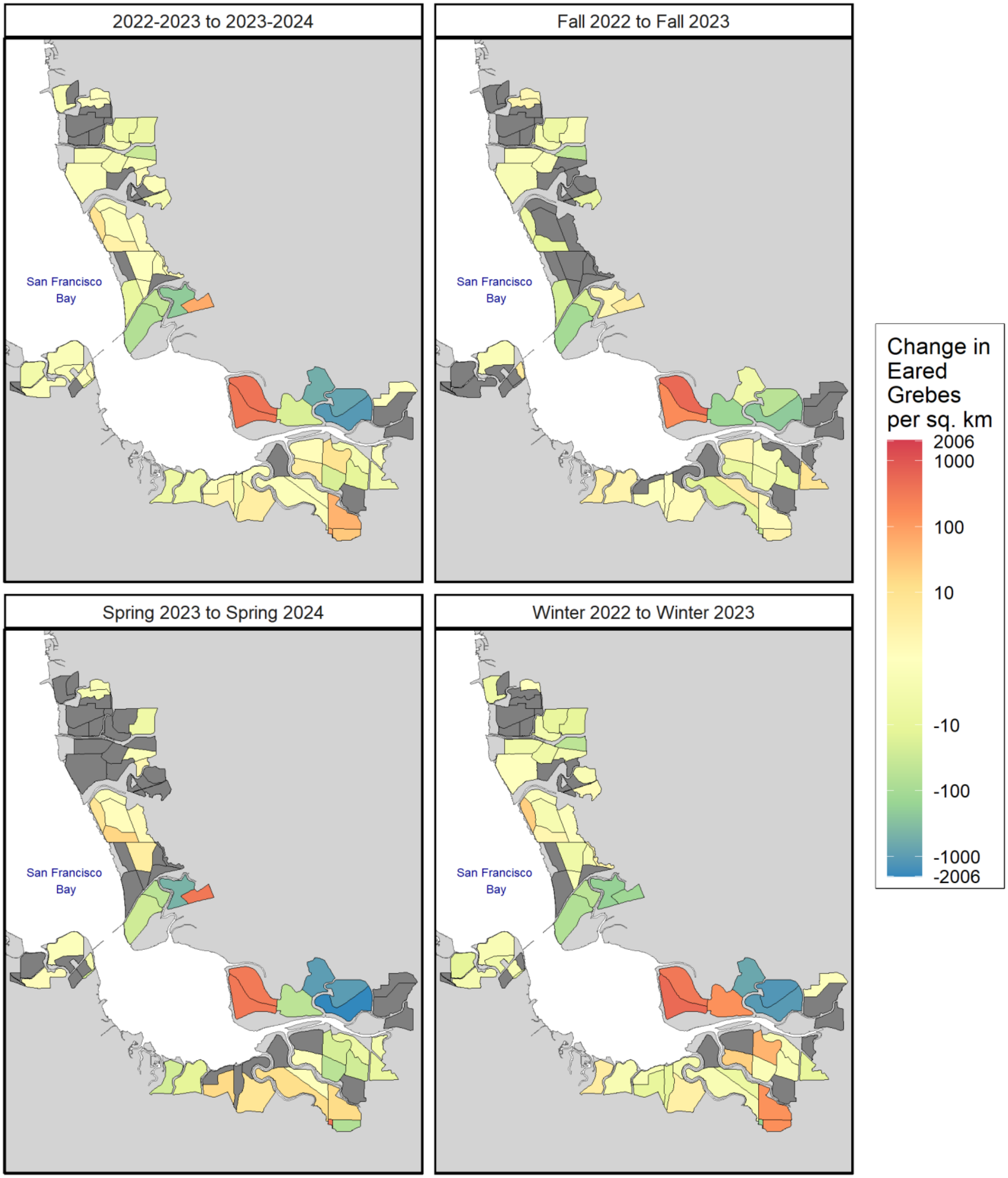

Figure 21. Interannual change in density of Eared Grebes between September 2022–May 2023 and September 2023–May 2024 in pond habitats of South San Francisco Bay, California. Seasonal panels are density averaged across survey rounds by season, while the Overall panel is averaged across all six survey periods. Dark grey ponds had no birds during that seasonal window in both the current and previous year.

Trends and Trigger Status

For Eared Grebes in winter, their management trigger—more than 25% below the 2005-2007 baseline winter abundance for the past three years, or more than 50% below in any single year—was not tripped this year because neither of these conditions were met, with counts below the 25% threshold in none of the three most recent years of complete surveys (Table 2). However, the trendline for Eared Grebes within the wildlife ponds continued to decline towards zero. The estimated multi-year trend for average winter abundance of Eared Grebes across the study area was -947 at the end of winter 2024. The trend within the SBSPRP-managed wildlife ponds (-34.09 per km^2, -946 total) was worse than the trend within the Cargill-managed salt ponds (+0.43 per km^2, +12 total). The trend within SBSPRP ponds that had been breached to restore tidal marsh was in-between the wildlife ponds and salt ponds (+0.36 per km^2, +10 total; Fig. 22).

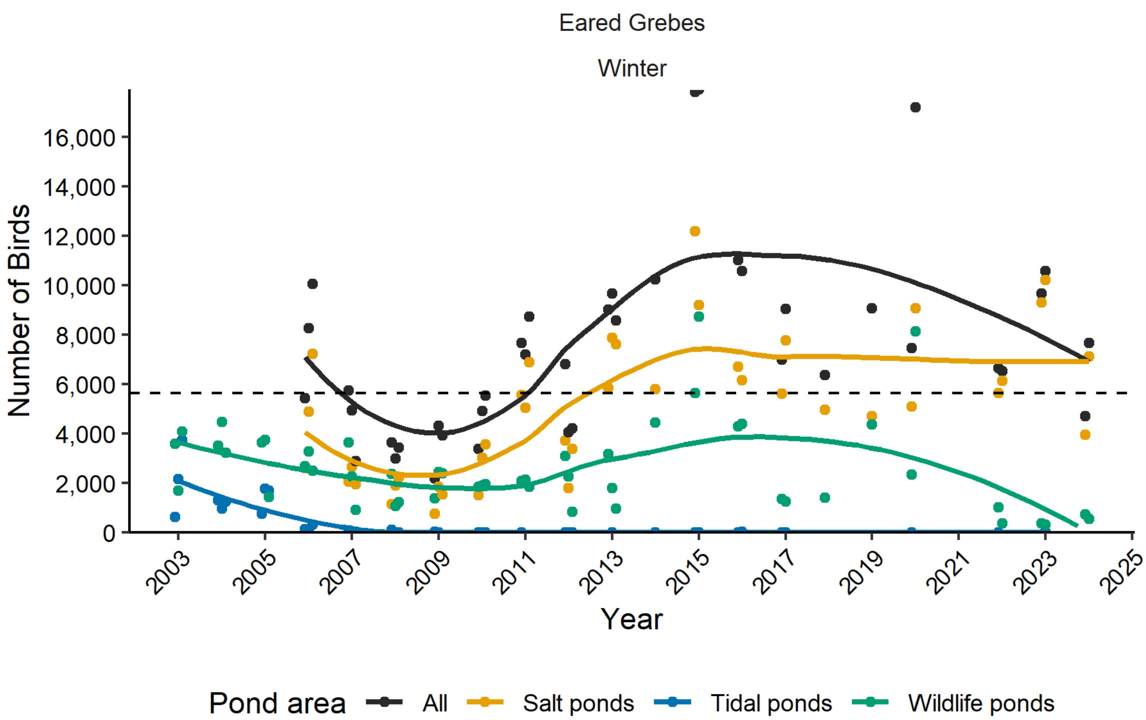

Figure 22. Counts of Eared Grebes during target season(s) within the South Bay Salt Pond Restoration Project (SBSPRP) and salt production ponds. Lines represent LOESS curves and the dashed lines denote SBSPRP targets or baseline values (average counts from 2005-2007). Ponds A20, A21, A6N, and E10X were excluded from analysis because they were not surveyed after tidal restoration.

Change Model

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. Despite strongly divergent patterns of decline within the SBSPRP footprint and increase within the salt production ponds, change in Eared Grebes abundance was not strongly related to any variable except a positive relationship with interannual increases in water elevation (a proxy for increasing water depth; Fig. 23). Both De La Cruz (2018) and Scullen et al. (2013) found that Eared Grebe abundances were higher at ponds with greater staff gauge values. This suggests possibly that the restoration activities or pond drawdowns could be a driving factor in the observed changes, but more analyses are necessary to disentangle whether this relationship could explain the decline within the SBSPRP, the increase within salt production ponds, or both. There was also support for mean maximum monthly winter temperatures and changes in dissolved oxygen explaining changes in Eared Grebe abundance (Table A5.4), but with large confidence intervals that overlapped zero (Fig. 23). Similarly, De La Cruz et al. (2018) did not find any relationships between abundance and water quality measures, though Scullen et al. (2013) found support for higher abundances at ponds with higher pH, higher salinity, and lower temperature. Changes in Eared Grebe abundance were not strongly related to pond characteristics.

We report predictions made by the change model within 55 ponds, excluding sites that were unoccupied by Eared Grebes in winter of both 2024 and 2023 (A12, A17, A19, A23, A6S, A9, E11, E13, E14, E1C, E2C, E4, E5C, E6C, E8AE, E8AW, E8X, E9, N4, N5, N9, R5, RS5, RSF2U1 and RSF2U3) and sites with missing water quality measurements (A8W). Across this set of sites, the actual change in abundance of Eared Grebes in winter was -3,762. In comparison, the model predicted a total change of -3,797, however it did not identify specific drivers of this decrease as the decline was primarily attributed to the random year effect. The proportion of variance in percent change in counts explained by the best model was low ($R^2c = 0.10$, $R^2m = 0.01$).

The change model estimated that changes in site hydrology could explain a 13 increase in abundance of Eared Grebes from last year due to increasing depth. The sites predicted to experience the largest increase in Eared Grebes abundance due to hydrology changes were M3, AB2, and E10, while the sites predicted to experience the largest increase in suitability (i.e., predicted percent change irrespective of actual abundance last year) were AB2, RSF2U4, and E10 (Table 8). The sites predicted to experience the largest negative impacts from changes in hydrology in winter 2024 were N1, N3, and A5 (based on predicted decreases in abundance) and M1, E6B, and N7 (based on predicted decrease in suitability). Static site characteristics (number of islands and pond area) accounted for an increase of 737 birds.

Weather was not a significant variable, but there was a substantial amount of change in abundance attributable to the unexplained annual variability (the random year effect), with this term in 2024 decreasing abundance by 3,699, some of which is likely due to complex effects of weather not included in the model.

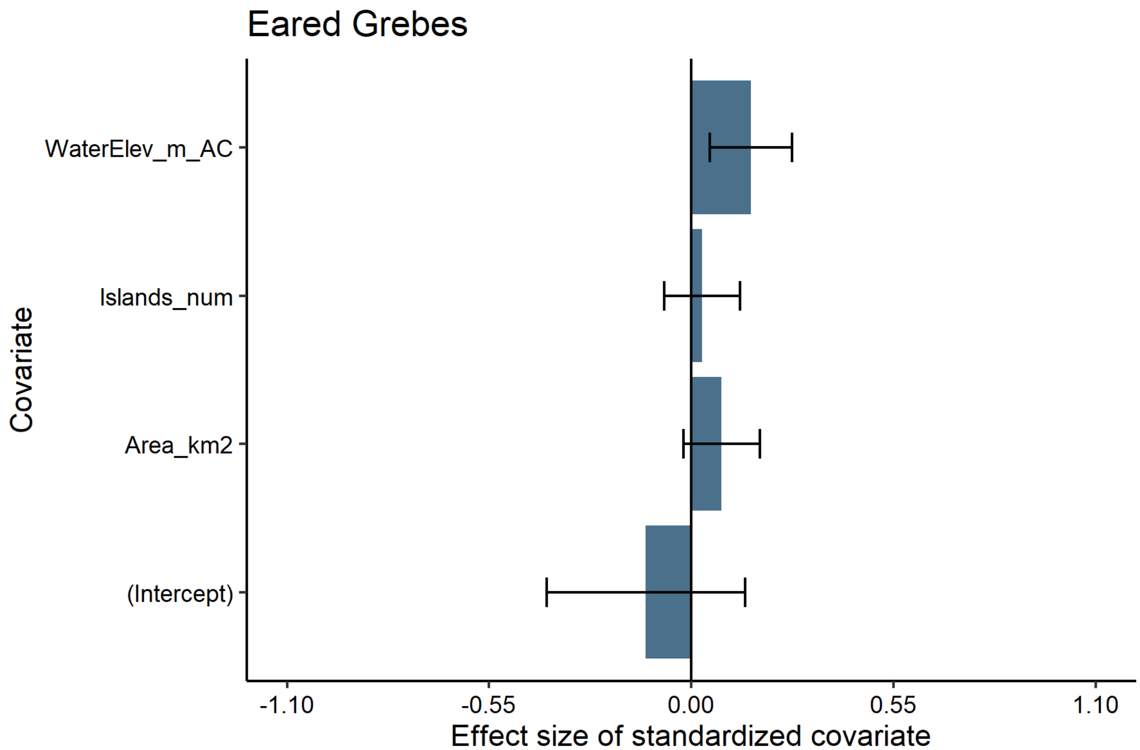

Figure 23. Fixed effects for the top model for interannual change in abundance of Eared Grebes during winter in current and former salt ponds in South San Francisco Bay, California, water year 2003–2024 (n = 1,023). Dark bars show coefficients and error bars show 95% confidence intervals.

Table 8. Actual and predicted changes in mean abundance per survey of Eared Grebes from winter 2023 to winter 2024 (sorted greatest decrease to greatest increase). Predicted effect sizes of covariate groups are shown for hydrology (depth; compared to no change from last year), static site characteristics (number of islands and pond area; compared to mean across all sites), and a year random effect. Change values were calculated by back-transforming the predictions on the ln(% change + 1) scale (shown in parentheses and interpretable as change in relative habitat suitability) and then multiplying by the actual previous year's abundance.

Pond	**Previous abun.**	**Current abun.**	**Actual change**	**Predicted change**	**Hydrology effect**	**Site effect**	**Year effect**
M4	4,044	1,682	-2,362 (-0.88)	-1,482 (-0.46)	0 (0.00)	+315 (+0.13)	-1,477 (-0.46)
M5	2,280	410	-1,870 (-1.71)	-869 (-0.48)	0 (0.00)	+145 (+0.11)	-814 (-0.46)
M6	1,249	1	-1,248 (-6.44)	-496 (-0.51)	0 (0.00)	+59 (+0.08)	-435 (-0.46)
N1	299	48	-252 (-1.82)	-164 (-0.79)	-35 (-0.23)	+3 (+0.02)	-79 (-0.46)
N3	164	0	-164 (-5.11)	-59 (-0.44)	-6 (-0.06)	+19 (+0.20)	-61 (-0.46)
NPP1	171	68	-103 (-0.91)	-82 (-0.65)	0 (0.00)	-6 (-0.06)	-52 (-0.46)
N2	40	0	-40 (-3.73)	-19 (-0.62)	0 (0.00)	-1 (-0.03)	-13 (-0.46)
E6	42	5	-38 (-1.98)	-20 (-0.64)	0 (0.00)	-1 (-0.05)	-13 (-0.46)
R4	27	0	-27 (-3.33)	-12 (-0.59)	0 (0.00)	-0 (-0.00)	-9 (-0.46)
E6A	16	2	-13 (-1.55)	-7 (-0.56)	0 (-0.00)	+0 (+0.03)	-5 (-0.46)
N7	14	1	-13 (-2.01)	-8 (-0.78)	-2 (-0.24)	+0 (+0.05)	-4 (-0.46)
A2E	22	10	-12 (-0.74)	-10 (-0.57)	0 (0.00)	+0 (+0.01)	-7 (-0.46)
E6B	10	0	-10 (-2.40)	-6 (-0.89)	-2 (-0.30)	-0 (-0.01)	-3 (-0.46)
A16	18	8	-10 (-0.69)	-8 (-0.51)	+1 (+0.06)	+0 (+0.01)	-7 (-0.46)
E10	8	0	-8 (-2.20)	-3 (-0.35)	+1 (+0.25)	-0 (-0.02)	-4 (-0.46)
A7	16	9	-7 (-0.53)	-7 (-0.54)	0 (0.00)	+0 (+0.04)	-6 (-0.46)
AB2	8	3	-5 (-0.81)	-1 (-0.17)	+2 (+0.34)	+1 (+0.08)	-4 (-0.46)
R3	5	0	-5 (-1.79)	-3 (-0.60)	0 (0.00)	-0 (-0.01)	-2 (-0.46)
A5	44	40	-4 (-0.09)	-19 (-0.54)	-4 (-0.16)	+5 (+0.20)	-15 (-0.46)

Pond	Previous abun.	Current abun.	Actual change	Predicted change	Hydrology effect	Site effect	Year effect
E1	4	0	-4 (-1.61)	-2 (-0.40)	+1 (+0.18)	+0 (+0.01)	-2 (-0.46)
E7	4	0	-4 (-1.61)	-2 (-0.62)	0 (0.00)	-0 (-0.03)	-2 (-0.46)
N4AB	11	7	-4 (-0.41)	-6 (-0.62)	0 (0.00)	-0 (-0.03)	-4 (-0.46)
R2	4	0	-4 (-1.61)	-2 (-0.67)	0 (0.00)	-0 (-0.09)	-1 (-0.46)
N3A	4	0	-4 (-1.50)	-2 (-0.58)	-0 (-0.06)	+0 (+0.07)	-1 (-0.46)
A13	3	0	-3 (-1.39)	-2 (-0.58)	0 (0.00)	+0 (+0.00)	-1 (-0.46)
A15	3	0	-3 (-1.39)	-2 (-0.64)	-0 (-0.03)	-0 (-0.02)	-1 (-0.46)
A2W	8	4	-3 (-0.44)	-3 (-0.46)	+0 (+0.03)	+1 (+0.10)	-3 (-0.46)
A3N	3	0	-3 (-1.39)	-2 (-0.65)	+0 (+0.01)	-0 (-0.07)	-1 (-0.46)
AB1	2	0	-2 (-1.10)	-2 (-0.73)	-0 (-0.07)	-0 (-0.07)	-1 (-0.46)
E4C	2	0	-2 (-1.10)	-1 (-0.60)	0 (0.00)	-0 (-0.02)	-1 (-0.46)
E8	2	0	-2 (-1.10)	-2 (-0.70)	-0 (-0.06)	-0 (-0.06)	-1 (-0.46)
N4AA	3	1	-2 (-0.69)	-2 (-0.73)	-0 (-0.14)	+0 (+0.00)	-1 (-0.46)
R1	3	1	-2 (-0.69)	-2 (-0.50)	0 (0.00)	+0 (+0.08)	-1 (-0.46)
E5	3	2	-2 (-0.47)	-2 (-0.69)	-0 (-0.03)	-0 (-0.07)	-1 (-0.46)
A22	1	0	-1 (-0.69)	-1 (-0.60)	0 (0.00)	-0 (-0.01)	-1 (-0.46)
E2	2	1	-1 (-0.41)	-0 (-0.17)	+0 (+0.16)	+1 (+0.26)	-1 (-0.46)
N1A	1	0	-1 (-0.69)	-1 (-0.59)	+0 (+0.07)	-0 (-0.07)	-1 (-0.46)
N6	1	0	-1 (-0.69)	-1 (-0.79)	-0 (-0.08)	-0 (-0.11)	-1 (-0.46)
N8	1	0	-1 (-0.69)	-1 (-0.93)	-0 (-0.24)	-0 (-0.10)	-0 (-0.46)
RSF2U2	1	0	-1 (-0.69)	-1 (-0.49)	+0 (+0.03)	+0 (+0.07)	-1 (-0.46)
RSF2U4	1	0	-1 (-0.69)	-1 (-0.45)	+0 (+0.30)	-0 (-0.16)	-1 (-0.46)
E12	1	1	0	-1	+0	-0	-1

Pond	Previous abun.	Current abun.	Actual change	Predicted change	Hydrology effect	Site effect	Year effect
			(0.00)	(-0.55)	(+0.14)	(-0.11)	(-0.46)
E3C	0	1	+1	-0	+0	-0	-0
			(+0.69)	(-0.51)	(+0.11)	(-0.04)	(-0.46)
N4B	0	1	+1	-1	0	-0	-0
			(+0.69)	(-0.72)	(0.00)	(-0.13)	(-0.46)
A11	4	7	+2	-2	0	-0	-2
			(+0.37)	(-0.61)	(0.00)	(-0.02)	(-0.46)
A1	5	10	+4	-3	+0	+0	-2
			(+0.56)	(-0.56)	(+0.02)	(+0.01)	(-0.46)
A3W	58	64	+7	-20	+1	+5	-22
			(+0.11)	(-0.41)	(+0.03)	(+0.15)	(-0.46)
N2A	4	17	+13	-3	-0	-0	-1
			(+1.28)	(-0.74)	(-0.08)	(-0.07)	(-0.46)
A10	4	26	+22	-2	0	-0	-2
			(+1.67)	(-0.61)	(0.00)	(-0.02)	(-0.46)
A14	14	84	+70	-7	-1	+0	-5
			(+1.73)	(-0.65)	(-0.08)	(+0.03)	(-0.46)
A8S	38	141	+102	-19	0	-2	-12
			(+1.28)	(-0.66)	(0.00)	(-0.07)	(-0.46)
A8	4	238	+234	-2	0	+0	-2
			(+3.97)	(-0.52)	(0.00)	(+0.06)	(-0.46)
M3	1,478	1,792	+314	-418	+58	+191	-611
			(+0.19)	(-0.33)	(+0.06)	(+0.20)	(-0.46)
M1	6	660	+654	-4	-2	+0	-1
			(+4.55)	(-1.02)	(-0.56)	(+0.13)	(-0.46)
M2	2	1,056	+1,054	-1	-0	+0	-1
			(+5.86)	(-0.65)	(-0.20)	(+0.14)	(-0.46)

Fisheaters

Abundance

Across all complexes, there were 16,015 total sightings of fisheaters (sum sightings during the entire survey period). Compared to the previous year, this was a decrease of 1,380 total sightings (-7.9%; Fig. 24). There were on average 1,112 fewer fisheaters detected per survey in fall (Table A2.4), 640 more detected in winter (Table A2.6), and 218 fewer detected in spring (Table A2.8, Fig. 24).

At the pond level, N4AB had the highest abundance (mean count of 446 per survey), followed by N3A (262) and A5 (196; Fig. 25). At these sites, we observed the majority of fisheaters roosting on levees (71.4%), foraging (53.1%), and roosting on levees (77.5%), respectively (Table A4.6). Across all six surveys, the sites with the largest increases in fisheaters from last year were N4AB (+335 mean abundance per visit), N3A (+60), and A8 (+59, while the sites with the largest decreases were A11 (-186), A7 (-115), and E1 (-74; Fig. 26). Seasonal abundance of fisheaters was exceptionally low (5th percentile) at A10 (22 birds in spring), A3W (27 in fall), and A9 (0 in spring). At E11 (19 birds in winter), abundance of fisheaters was higher than ever previously recorded there.

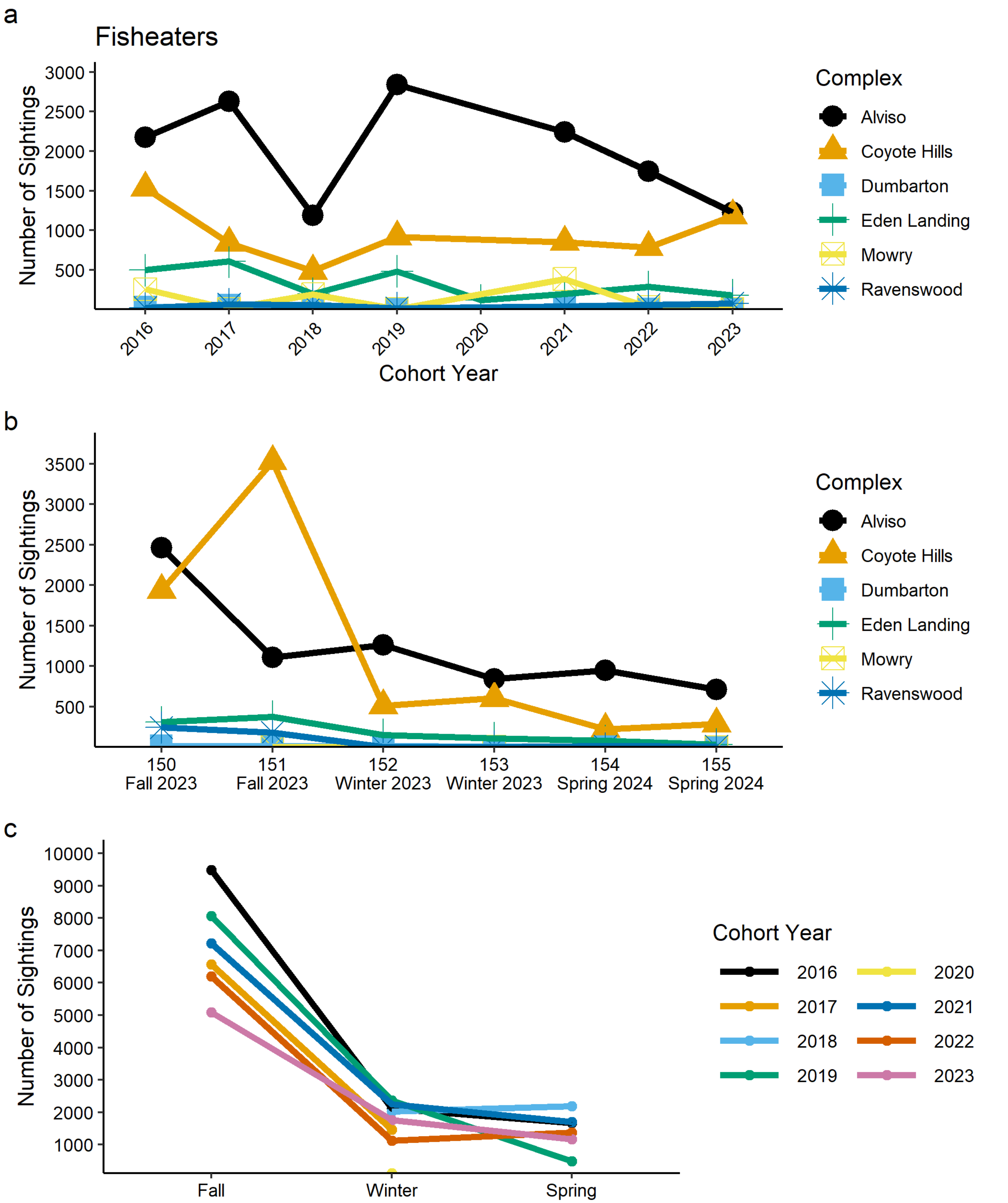

Figure 24. Abundance of fisheaters by (a) study year (September to August of the following year) for each complex (averaged across surveys), (b) survey period for each complex during the current report period (September 2023 – May 2024), and (c) season for each study year at all salt production ponds combined; South San Francisco Bay, California, Sept. 2005 – May 2024 (averaged across surveys). Study years 2019 and 2020 contain incomplete survey rounds.

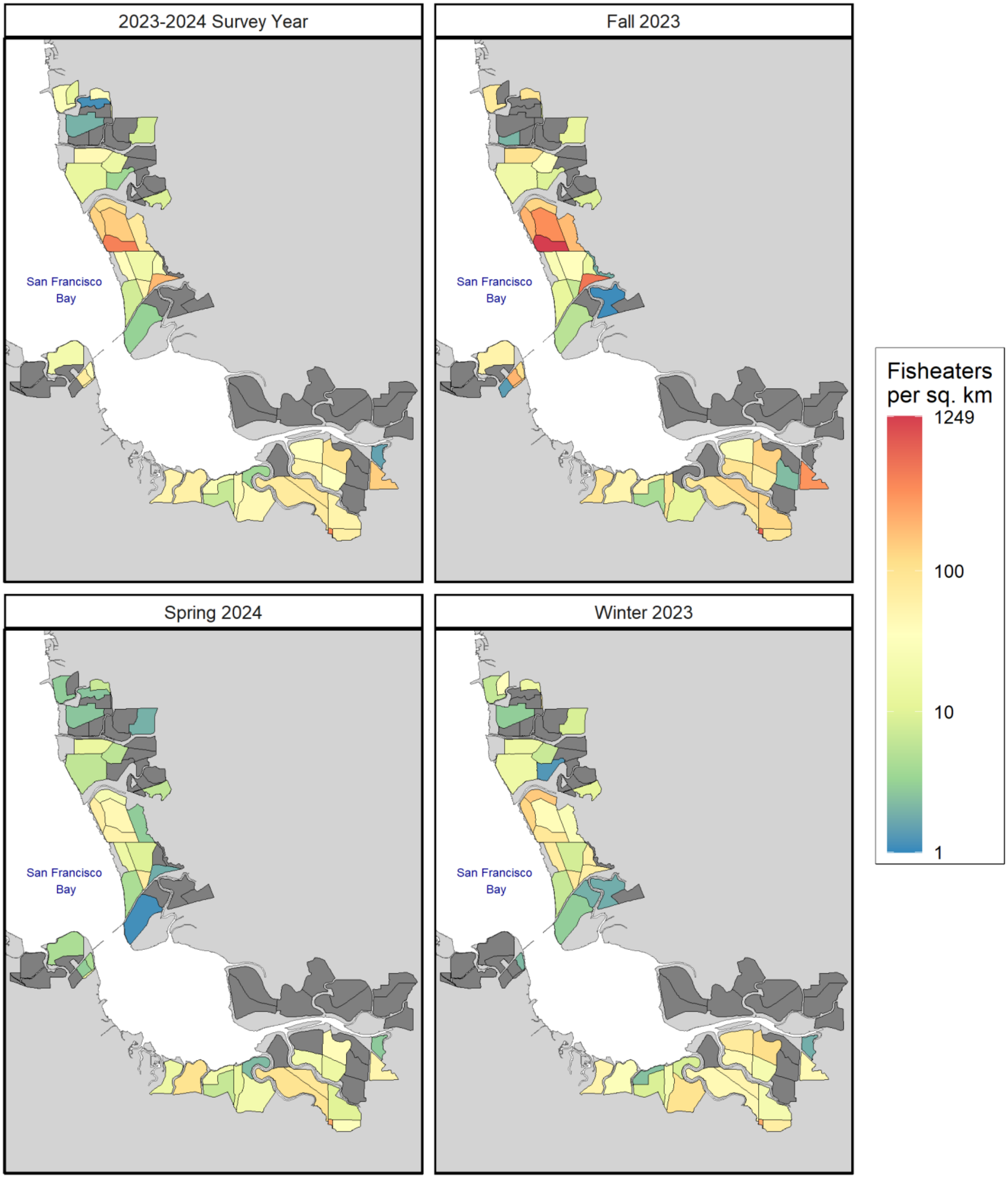

Figure 25. Density of fisheaters averaged across survey rounds by season, South San Francisco Bay, California; September 2023–May 2024. Dark grey ponds had no birds.

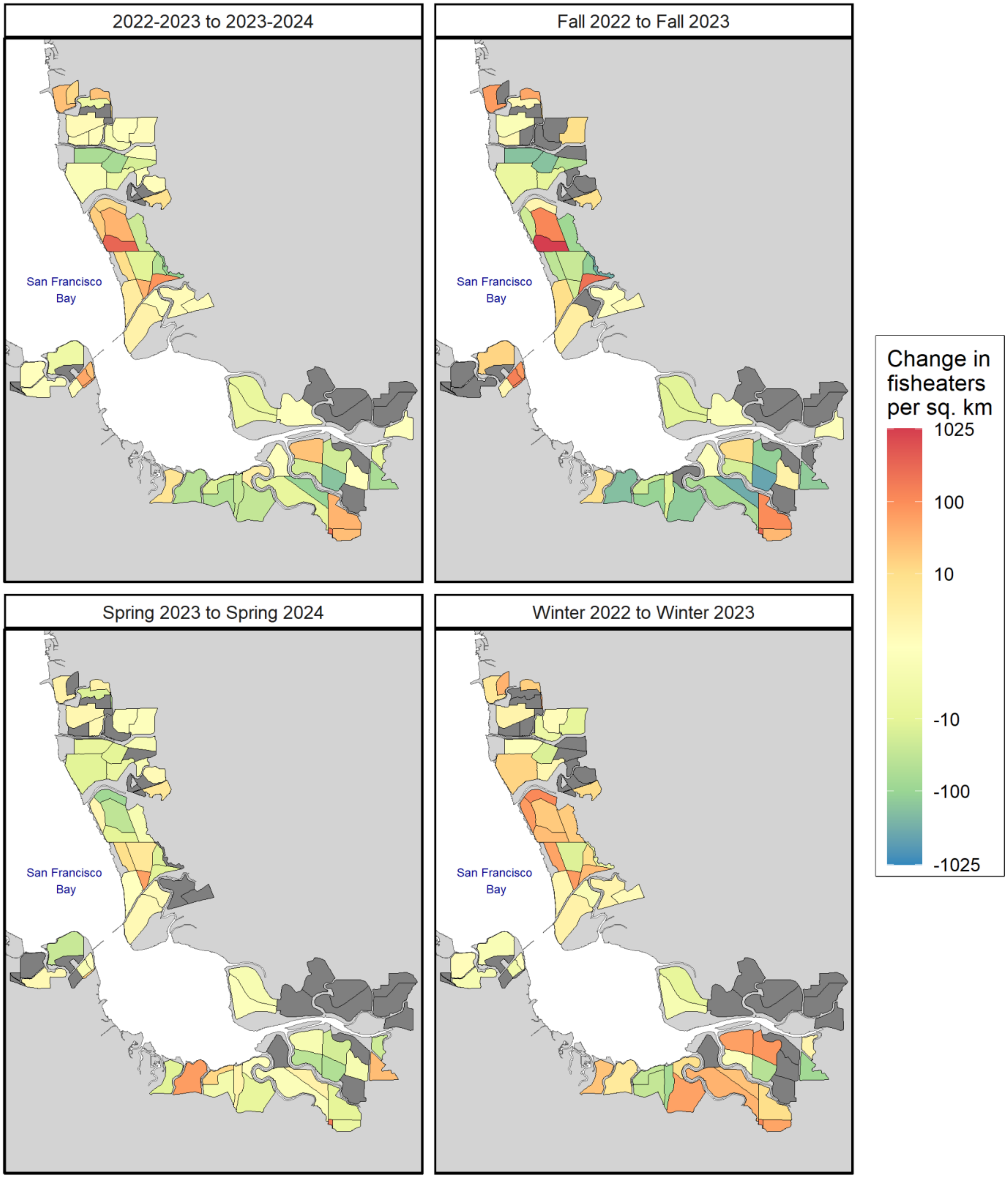

Figure 26. Interannual change in density of fisheaters between September 2022–May 2023 and September 2023–May 2024 in pond habitats of South San Francisco Bay, California. Seasonal panels are density averaged across survey rounds by season, while the Overall panel is averaged across all six survey periods. Dark grey ponds had no birds during that seasonal window in both the current and previous year.

Trends and Trigger Status

No formal targets have been set for fisheaters, but we still provide a comparison to a hypothetical management trigger based on baseline abundance for a more comprehensive assessment of waterbird populations within the South Bay. For fisheaters in fall, this hypothetical trigger—two or more of the past three years of fall abundance below the 2005-2007 baseline value—was tripped this year because average seasonal abundance was below this threshold in all three of the three most recent years of complete surveys (Table 2). The estimated multi-year trend for average fall abundance of fisheaters across the study area was -919 at the end of fall 2024. The trend within the SBSPRP-managed wildlife ponds (-26.97 per km^2, -748 total) was worse than the trend within the Cargill-managed salt ponds (-3.58 per km^2, -99 total). The trend within SBSPRP ponds that had been breached to restore tidal marsh was better than both the wildlife ponds and salt ponds (+0.27 per km^2, +8 total; Fig. 27).

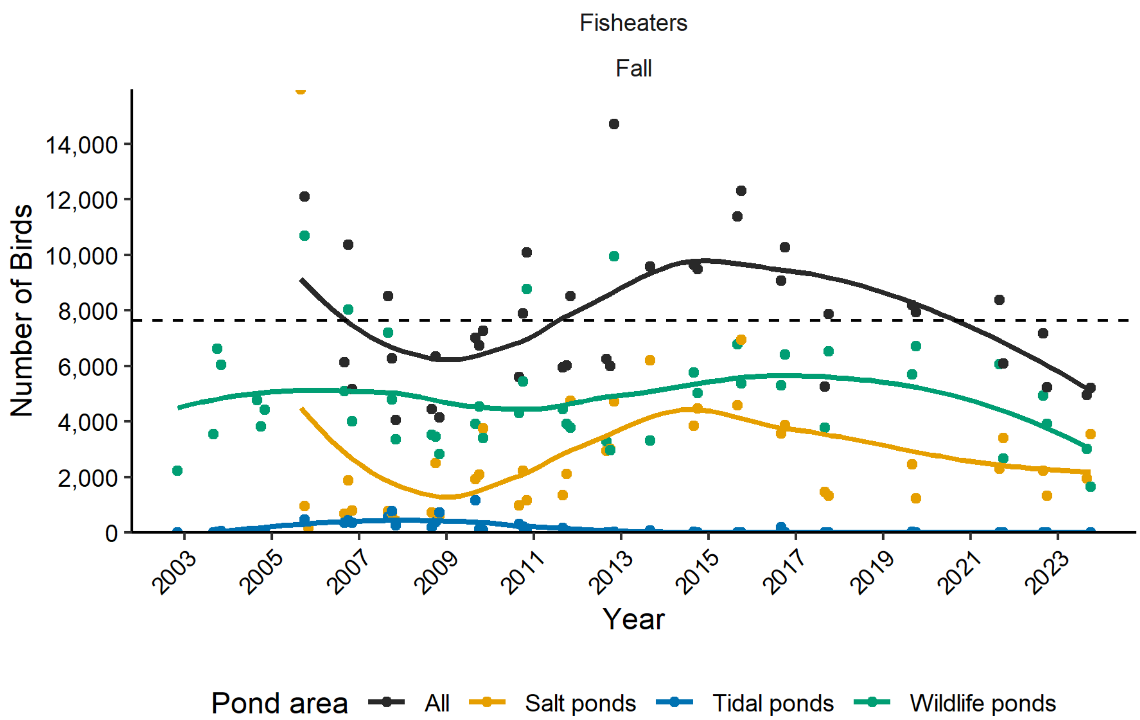

Figure 27. Counts of fisheaters during target season(s) within the South Bay Salt Pond Restoration Project (SBSPRP) and salt production ponds. Lines represent LOESS curves and the dashed lines denote SBSPRP targets or baseline values (average counts from 2005-2007). Ponds A20, A21, A6N, and E10X were excluded from analysis because they were not surveyed after tidal restoration.

Gulls

Abundance

Across all complexes, there were 62,646 total sightings of gulls (sum sightings during the entire survey period). Compared to the previous year, this was a decrease of 22,381 total sightings (-26.3%; Fig. 28). There were on average 2,015 fewer gulls detected per survey in fall (Table A2.4), 2,122 fewer detected in winter (Table A2.6), and 7,054 fewer detected in spring (Table A2.8, Fig. 28).

At the pond level, A12 had the highest abundance (mean count of 660 per survey), followed by N3A (631) and A2E (549; Fig. 29). At these sites, we observed the majority of gulls roosting on the pond (95.5%), roosting on levees (88.6%), and roosting on levees (92.3%), respectively (Table A4.7). Across all six surveys, the sites with the largest increases in gulls from last year were N1 (+370 mean abundance per visit), A2E (+243), and N9 (+218, while the sites with the largest decreases were N6 (-572), A5 (-557), and AB2 (-475; Fig. 30). Seasonal abundance of gulls was exceptionally low (5th percentile) at A1 (1 birds in spring), A10 (6 in fall), A10 (4 in winter), A11 (6 in winter), A6S (0 in spring), and N3 (3 in winter). At A2E (1,120 birds in spring), abundance of gulls was higher than ever previously recorded there.

Note that the numbers in this section and the next two sections include counts of Bonaparte's Gulls, which we also assessed as a separate sub-group in a following section. In addition, while in the winter there are a diversity of gull species present, the presence of gulls on levees in the spring is largely due to summer California Gull breeding colonies. Supplementary surveys of California Gull nesting colonies (Parsons & Van Schmidt 2025) found an estimated 21,781 breeding pairs of California Gulls in May 2024, a decrease of 1,069 (4.7%) since May 2023.

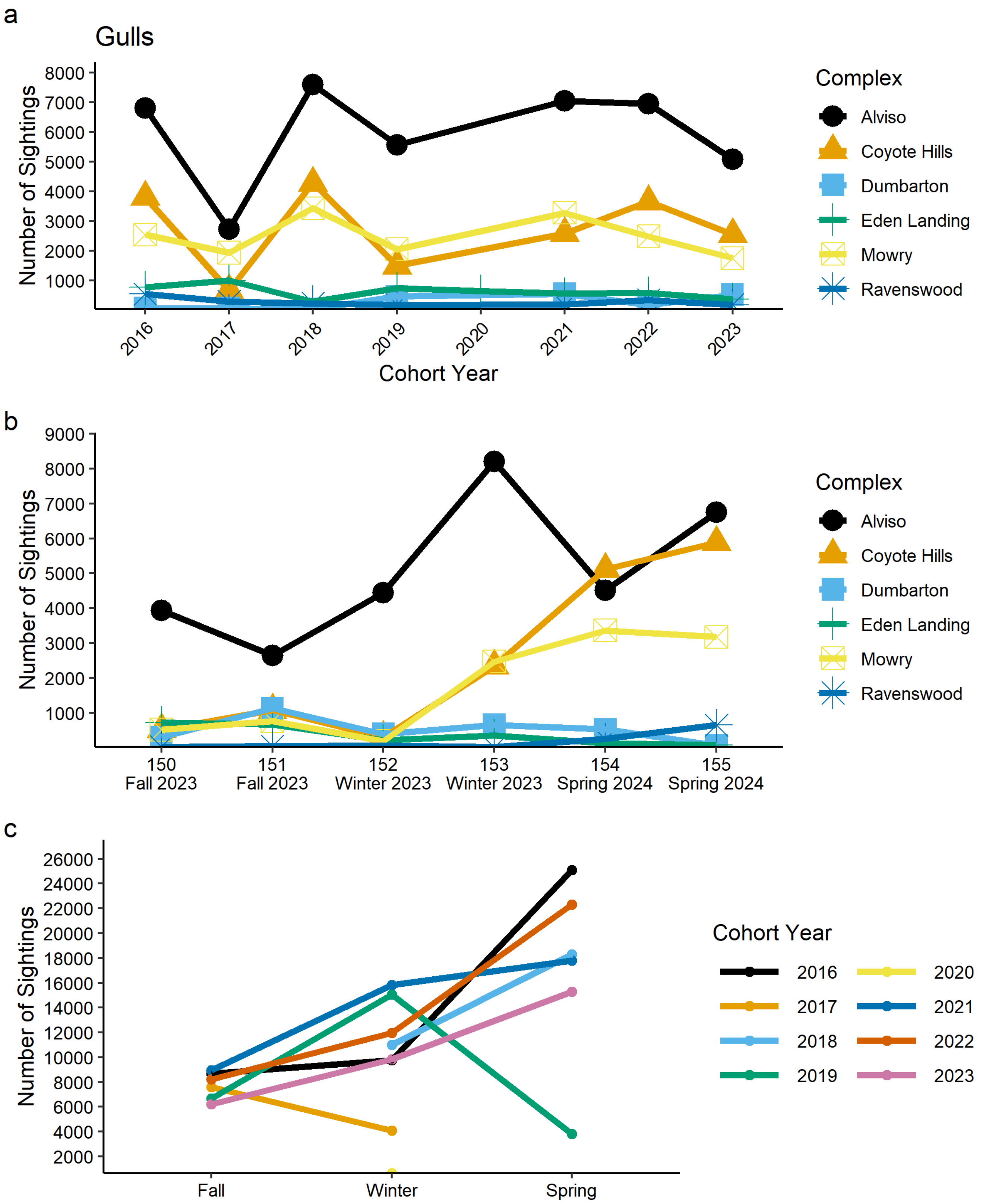

Figure 28. Abundance of gulls by (a) study year (September to August of the following year) for each complex (averaged across surveys), (b) survey period for each complex during the current report period (September 2023 – May 2024), and (c) season for each study year at all salt production ponds combined; South San Francisco Bay, California, Sept. 2005 – May 2024 (averaged across surveys). Study years 2019 and 2020 contain incomplete survey rounds.

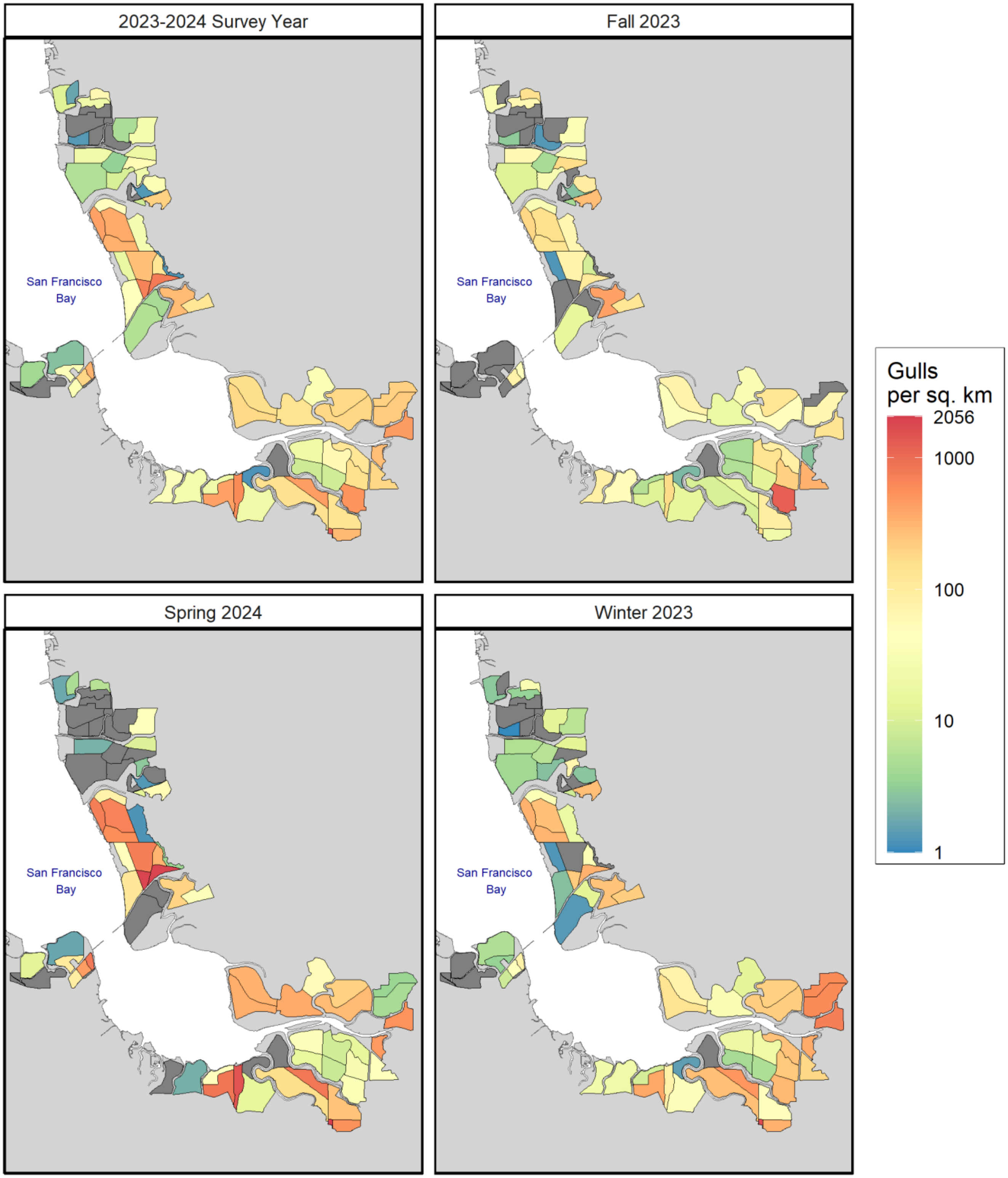

Figure 29. Density of gulls averaged across survey rounds by season, South San Francisco Bay, California; September 2023–May 2024. Dark grey ponds had no birds.

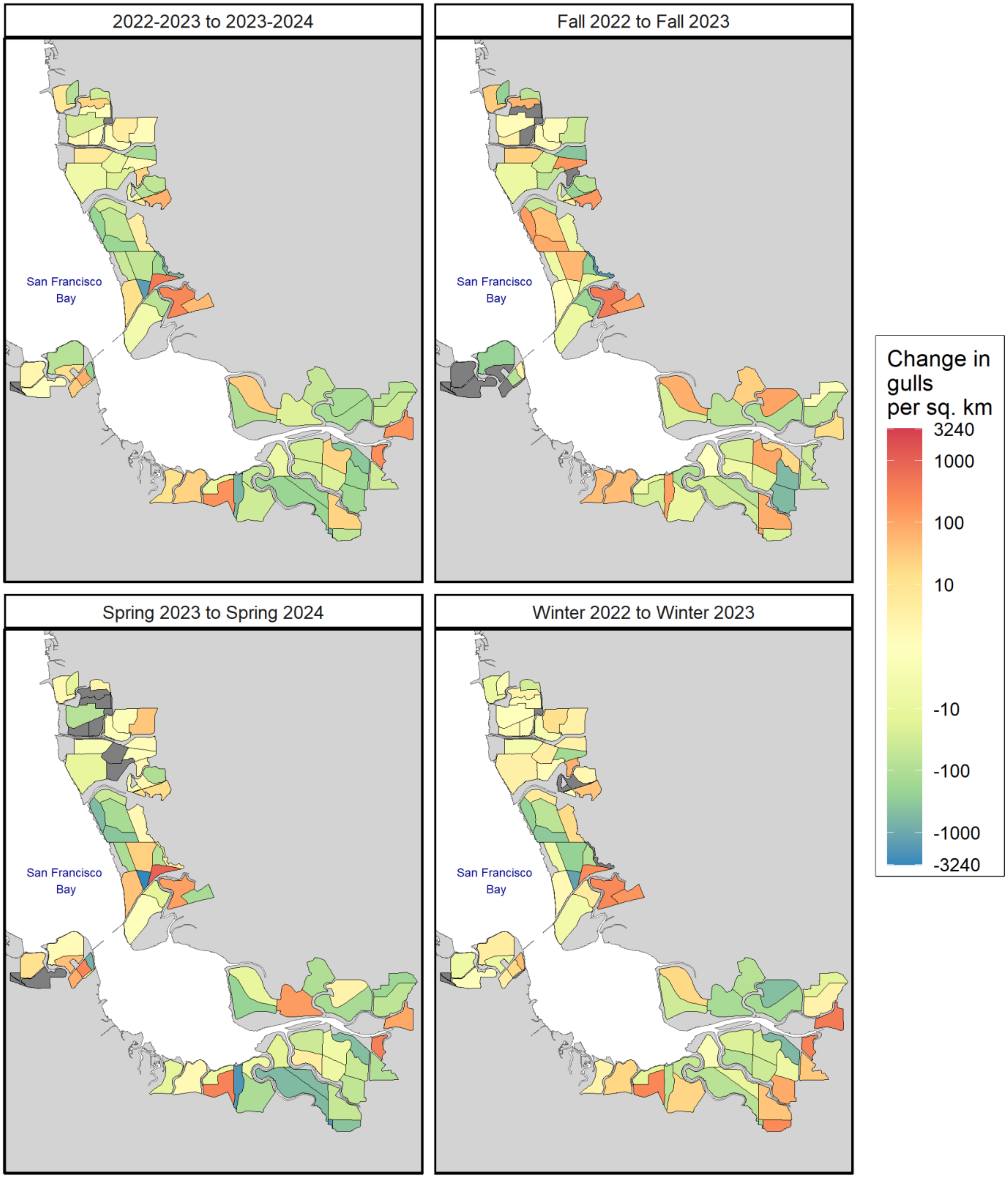

Figure 30. Interannual change in density of gulls between September 2022–May 2023 and September 2023–May 2024 in pond habitats of South San Francisco Bay, California. Seasonal panels are density averaged across survey rounds by season, while the Overall panel is averaged across all six survey periods. Dark grey ponds had no birds during that seasonal window in both the current and previous year.

Trends and Trigger Status

No formal targets have been set for gulls, but we still provide a comparison to a hypothetical management trigger based on baseline abundance for a more comprehensive assessment of waterbird populations within the South Bay. For gulls in spring, this hypothetical trigger—two or more of the past three years of spring abundance below the 2005-2007 baseline value—was tripped this year because average seasonal abundance was below this threshold in all three of the three most recent years of complete surveys (Table 2). The estimated multi-year trend for average spring abundance of gulls across the study area was -1,283 at the end of spring 2024. The trend within the SBSPRP-managed wildlife ponds (-66.09 per km^2, -1,833 total) was worse than the trend within the Cargill-managed salt ponds (-4.38 per km^2, -122 total). The trend within SBSPRP ponds that had been breached to restore tidal marsh was better than both the wildlife ponds and salt ponds (+18.28 per km^2, +507 total; Fig. 31).

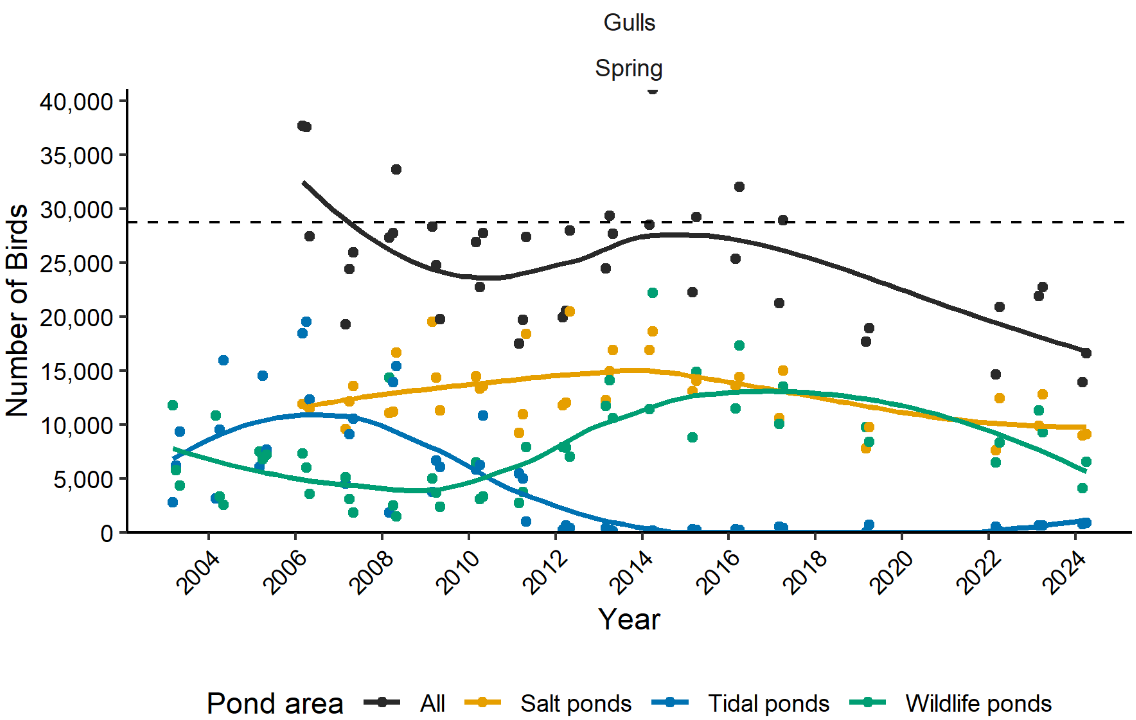

Figure 31. Counts of gulls during target season(s) within the South Bay Salt Pond Restoration Project (SBSPRP) and salt production ponds. Lines represent LOESS curves and the dashed lines denote SBSPRP targets or baseline values (average counts from 2005-2007). Ponds A20, A21, A6N, and E10X were excluded from analysis because they were not surveyed after tidal restoration.

Bonaparte's Gulls

Abundance

Across all complexes, there were 3,986 total sightings of Bonaparte's Gulls (sum sightings during the entire survey period). Compared to the previous year, this was an increase of 2,420 total sightings (+154.5%; Fig. 32). There were on average 682 more Bonaparte's Gulls detected per survey in fall (Table A2.4), 52 more detected in winter (Table A2.6), and 475 more detected in spring (Table A2.8, Fig. 32).

At the pond level, N1 had the highest abundance (mean count of 349 per survey), followed by A5 (116) and NPP1 (37; Fig. 33). At these sites, we observed the majority of Bonaparte's Gulls foraging (89.1%), foraging (98.1%), and foraging (76.7%), respectively (Table A4.8). Across all six surveys, the sites with the largest increases in Bonaparte's Gulls from last year were N1 (+349 mean abundance per visit), A5 (+116), and NPP1 (+43, while the sites with the largest decreases were M5 (-181), E5 (-32), and M3 (-20; Fig. 34).

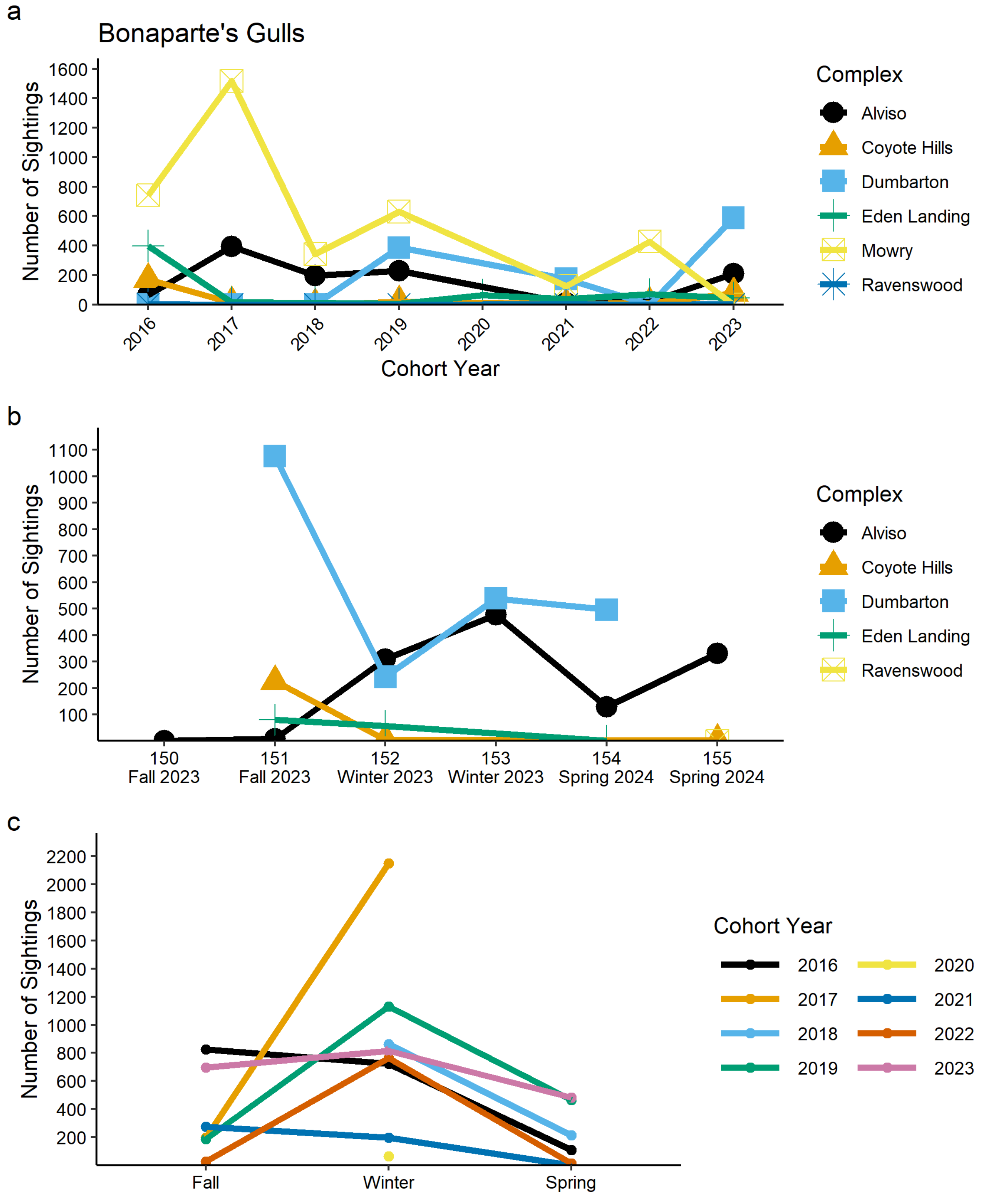

Figure 32. Abundance of Bonaparte's Gulls by (a) study year (September to August of the following year) for each complex (averaged across surveys), (b) survey period for each complex during the current report period (September 2023 – May 2024), and (c) season for each study year at all salt production ponds combined; South San Francisco Bay, California, Sept. 2005 – May 2024 (averaged across surveys). Study years 2019 and 2020 contain incomplete survey rounds.

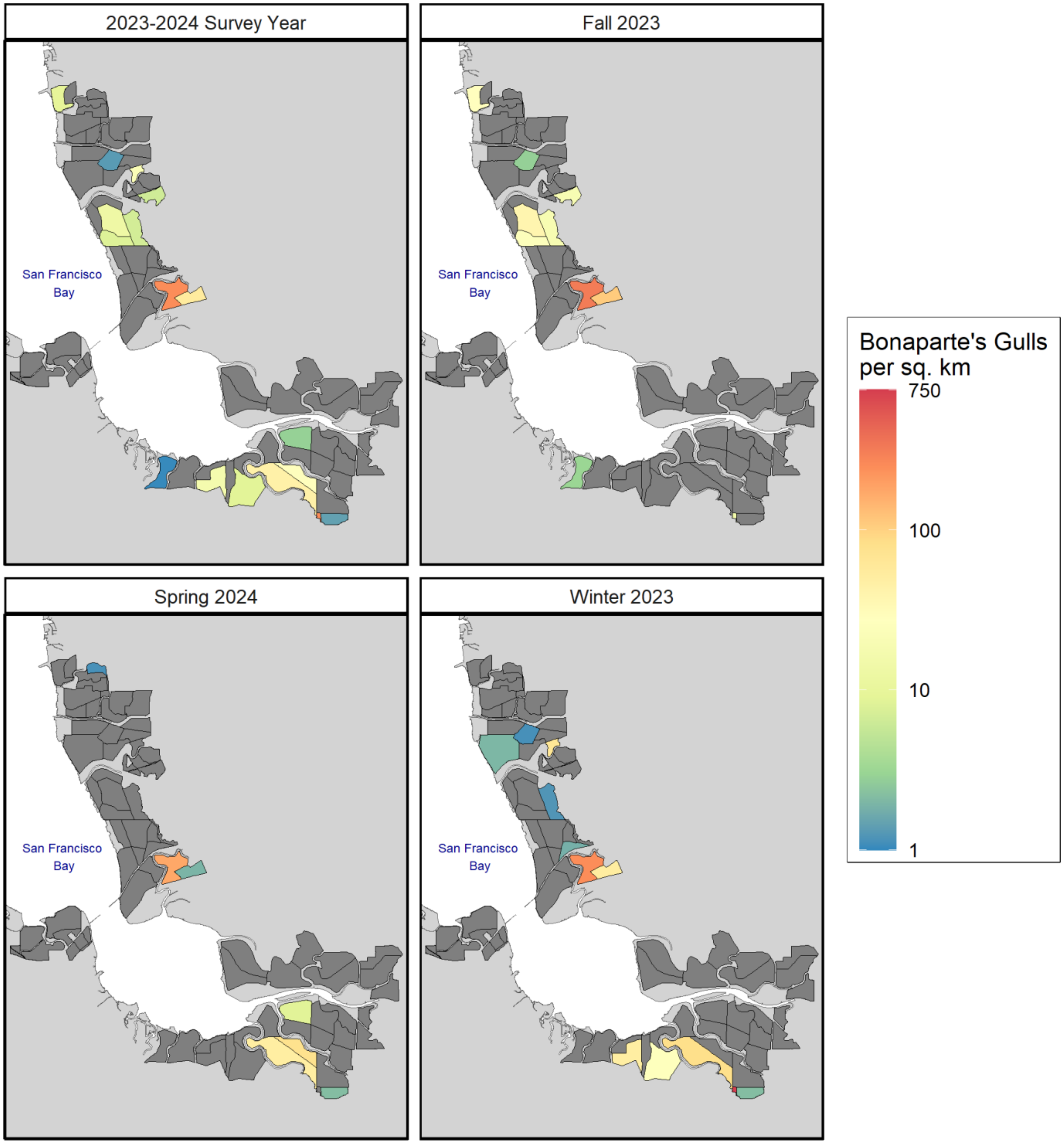

Figure 33. Density of Bonaparte's Gulls averaged across survey rounds by season, South San Francisco Bay, California; September 2023–May 2024. Dark grey ponds had no birds.

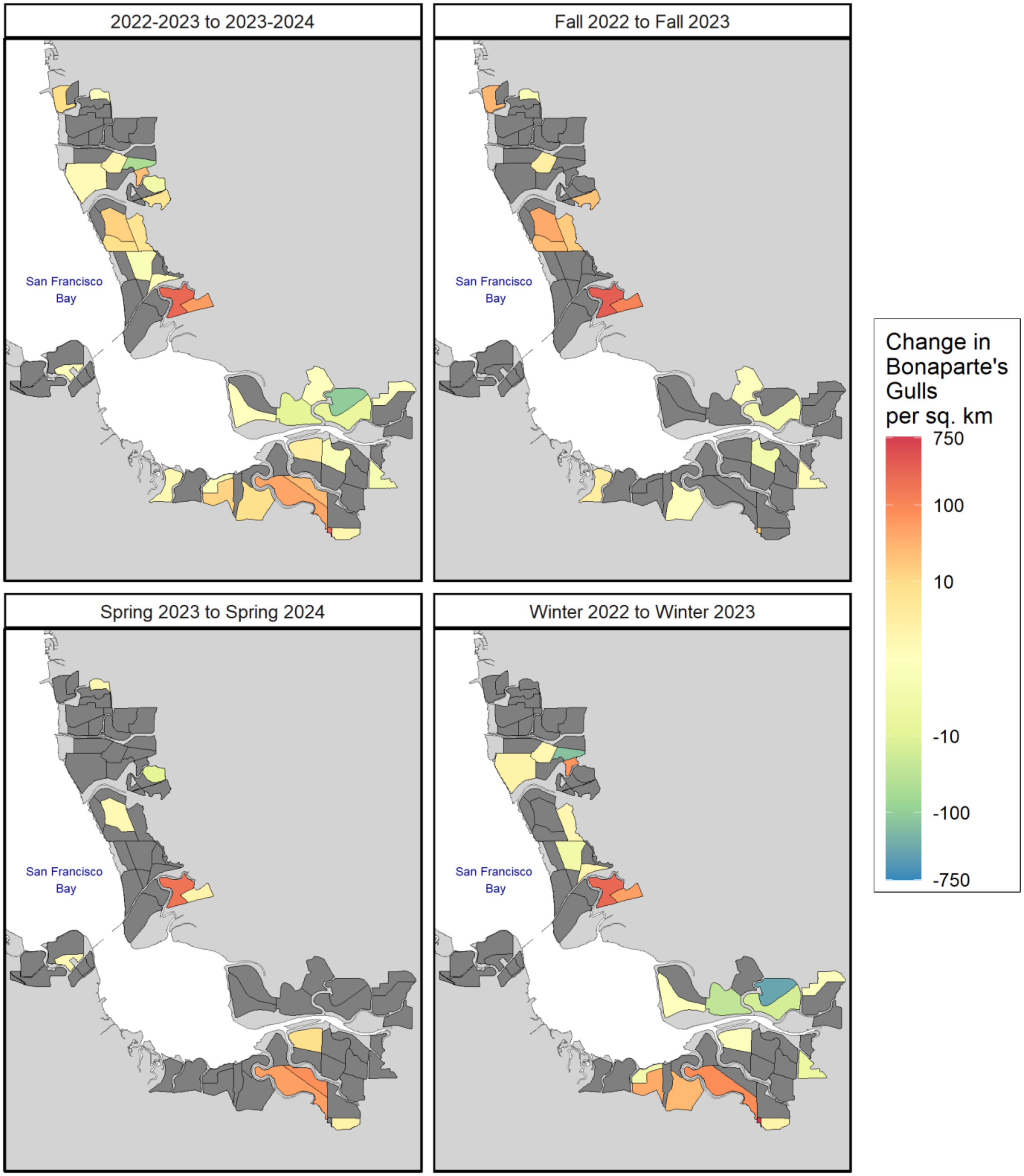

Figure 34. Interannual change in density of Bonaparte's Gulls between September 2022–May 2023 and September 2023–May 2024 in pond habitats of South San Francisco Bay, California. Seasonal panels are density averaged across survey rounds by season, while the Overall panel is averaged across all six survey periods. Dark grey ponds had no birds during that seasonal window in both the current and previous year.

Trends and Trigger Status

For Bonaparte's Gulls in winter, their management trigger—more than 25% below the 2005-2007 baseline winter abundance for the past three years, or more than 50% below in any single year—was tripped this year because both conditions were met: declines exceeded 25% in all three years and exceeded 50% in one of those years (Table 2). The estimated multi-year trend for average winter abundance of Bonaparte's Gulls across the study area was -108 at the end of winter 2024. The trend within the SBSPRP-managed wildlife ponds (-0.39 per km^2, -11 total) was better than the trend within the Cargill-managed salt ponds (-2.75 per km^2, -76 total). The trend within SBSPRP ponds that had been breached to restore tidal marsh was better than both the wildlife ponds and salt ponds (-0.29 per km^2, -8 total; Fig. 35).

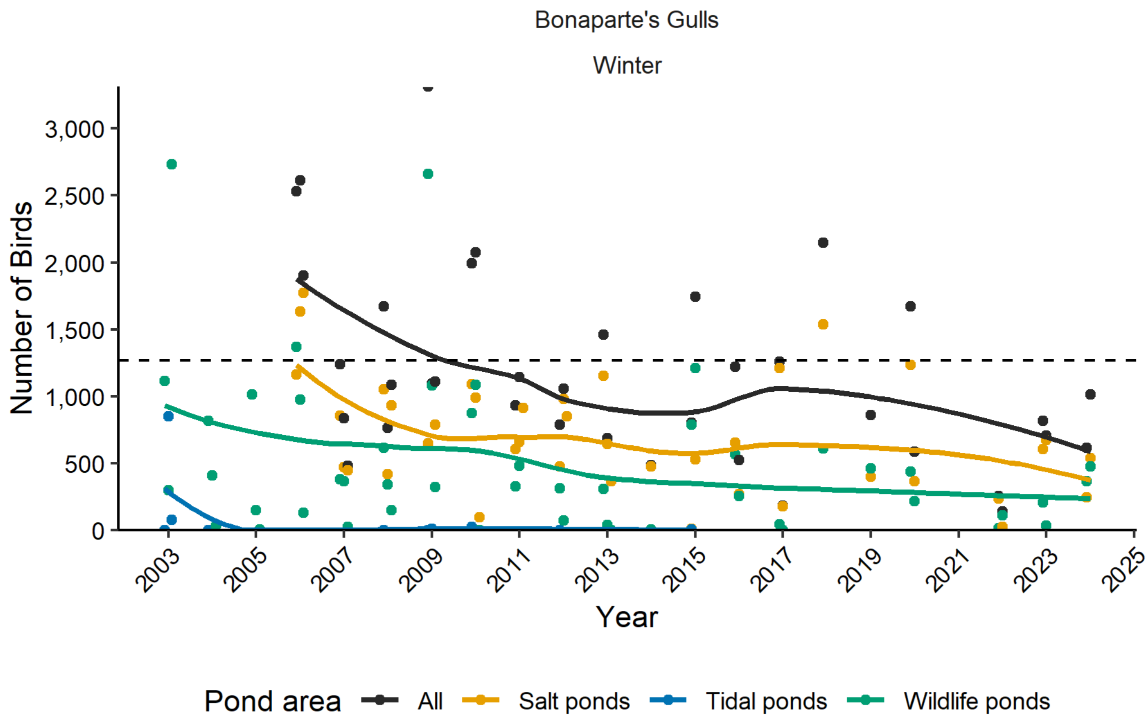

Figure 35. Counts of Bonaparte's Gulls during target season(s) within the South Bay Salt Pond Restoration Project (SBSPRP) and salt production ponds. Lines represent LOESS curves and the dashed lines denote SBSPRP targets or baseline values (average counts from 2005-2007). Ponds A20, A21, A6N, and E10X were excluded from analysis because they were not surveyed after tidal restoration.

Change Model

In the population change models, all assessed variables had confidence intervals overlapped zero for Bonaparte's Gulls, indicating our models had weak explanatory power for identifying drivers of changes in abundance of this species (Fig. 36). However, support for several variables was observed based on AICc (Table A5.5). Decreasing salinity was the variable with the strongest support for the observed decline, and more saline sites were more likely to experience population growth (Fig. 36). Temperature showed the largest effect sizes, but effects were inconsistent, with trends showing that increasing minimum temperature related to increased population size but warmer water temperatures related to decreased population size (or vice-versa). Benefits from higher dissolved oxygen were weakly supported, with very large confidence intervals. Base model selection on site covariates showed that site covariates did not affect change in abundance (Table A5.13).

We report predictions made by the change model within 21 ponds, excluding sites that were unoccupied by Bonaparte's Gulls in winter of both 2024 and 2023 (A1, A10, A11, A12, A13, A14, A15, A17, A19, A23, A2W, A3N, A6S, A7, A8, AB2, E1, E10, E11, E12, E13, E14, E1C, E2C, E3C, E4, E4C, E5C, E6, E6A, E6B, E8, E8AE, E8AW, E8X, E9, M1, M6, N1A, N2, N2A, N3, N3A, N4, N4AB, N4B, N5, N6, N8, R1, R2, R3, R4, R5, RS5, RSF2U1, RSF2U2, RSF2U3 and RSF2U4) and sites with missing water quality measurements (A8W). Across this set of sites, the actual change in abundance of Bonaparte's Gulls in winter was -58. In comparison, the model predicted a total change of -193, with this decrease driven by effects of changes in site hydrology. The proportion of variance in percent change in counts explained by the best model was low ($R^2c = 0.10$, $R^2m = 0.02$).

The change model estimated that changes in site hydrology could explain a 734 decrease in abundance of Bonaparte's Gulls from last year due to increasing water temperature. The sites predicted to experience the largest increase in Bonaparte's Gulls abundance due to hydrology changes were E2, E7, and N4AA, while the sites predicted to experience the largest increase in suitability (i.e., predicted percent change irrespective of actual abundance last year) were E2, E7, and N4AA (Table 9). The sites predicted to experience the largest negative impacts from changes in hydrology in winter 2024 were M5, M3, and E5 (based on predicted decreases in abundance) and A9, M5, and M3 (based on predicted decrease in suitability). No static site characteristics were included in the top model.

Weather was not a significant variable, but there was a significant amount of change in abundance attributable to the unexplained annual variability (the random year effect). This term in 2024 increased abundance by 236, some of which is likely due to complex effects of weather not included in the model.

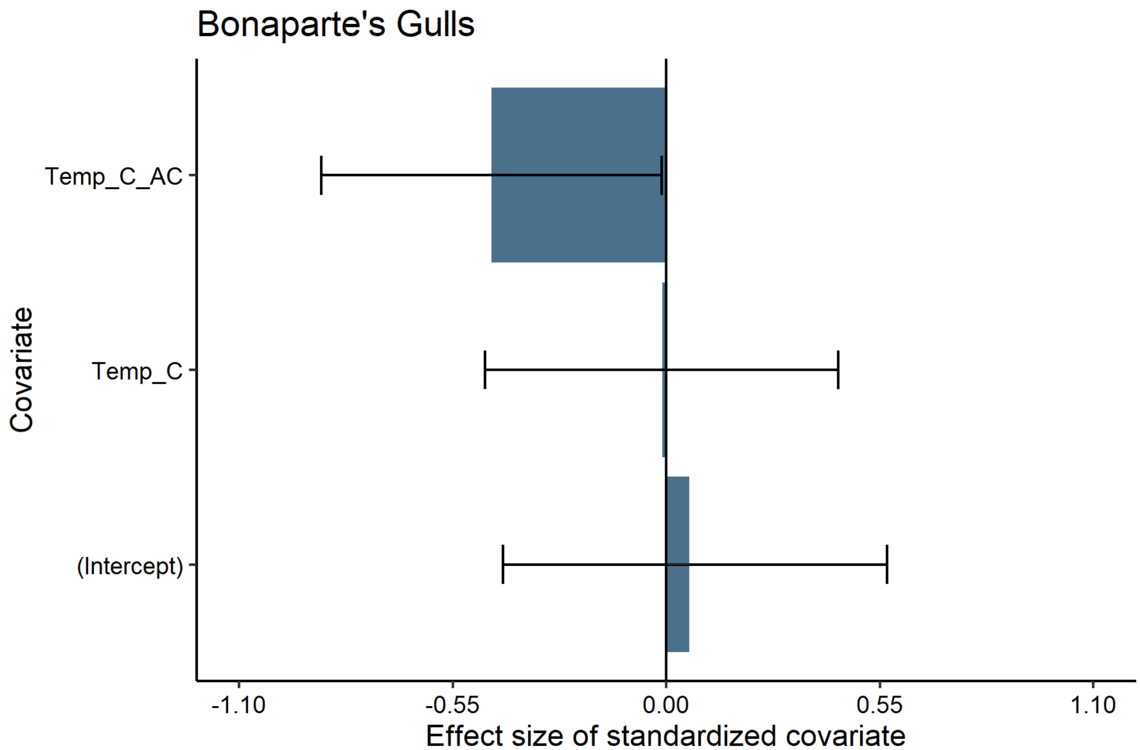

Figure 36. Fixed effects for the top model for interannual change in abundance of Bonaparte's Gulls during winter in current and former salt ponds in South San Francisco Bay, California, water year 2003–2024 (n = 381). Dark bars show coefficients and error bars show 95% confidence intervals.

Table 9. Actual and predicted changes in mean abundance per survey of Bonaparte's Gulls from winter 2023 to winter 2024 (sorted greatest decrease to greatest increase). Predicted effect sizes of covariate groups are shown for hydrology (water temperature; compared to no change from last year) and a year random effect. Change values were calculated by back-transforming the predictions on the ln(% change + 1) scale (shown in parentheses and interpretable as change in relative habitat suitability) and then multiplying by the actual previous year's abundance.

Pond	Previous abun.	Current abun.	Actual change	Predicted change	Hydrology effect	Year effect
M5	542	0	-542 (-6.30)	-185 (-0.42)	-484 (-0.85)	+107 (+0.35)
E5	193	0	-193 (-5.27)	+40 (+0.19)	-64 (-0.24)	+70 (+0.35)
M3	120	0	-120 (-4.80)	-41 (-0.41)	-107 (-0.84)	+24 (+0.35)
M4	68	0	-68 (-4.23)	-5 (-0.07)	-43 (-0.51)	+19 (+0.35)
A16	10	0	-10 (-2.40)	+1 (+0.12)	-5 (-0.31)	+4 (+0.35)
N7	9	0	-9 (-2.30)	-1 (-0.07)	-6 (-0.51)	+3 (+0.35)
AB1	3	0	-3 (-1.39)	-1 (-0.35)	-3 (-0.79)	+1 (+0.35)
A22	1	0	-1 (-0.69)	+1 (+0.28)	-0 (-0.16)	+1 (+0.35)
A9	1	0	-1 (-0.69)	-1 (-1.05)	-2 (-1.52)	+0 (+0.35)
M2	1	0	-1 (-0.69)	-0 (-0.19)	-1 (-0.63)	+0 (+0.35)
E7	0	2	+2 (+1.10)	+1 (+0.72)	+1 (+0.30)	+1 (+0.35)
N9	0	2	+2 (+1.10)	-0 (-0.28)	-1 (-0.74)	+0 (+0.35)
A8S	0	3	+3 (+1.39)	+0 (+0.01)	-1 (-0.43)	+0 (+0.35)
N4AA	0	3	+3 (+1.39)	+1 (+0.49)	+0 (+0.06)	+0 (+0.35)
E2	0	11	+11 (+2.48)	+1 (+0.75)	+1 (+0.34)	+1 (+0.35)
E6C	0	44	+44 (+3.81)	-0 (-0.19)	-1 (-0.62)	+0 (+0.35)
A3W	0	60	+60 (+4.12)	-0 (-0.31)	-1 (-0.76)	+0 (+0.35)
NPP1	0	82	+82 (+4.42)	+0 (+0.40)	-0 (-0.03)	+0 (+0.35)
A2E	18	134	+116 (+1.96)	-6 (-0.35)	-16 (-0.79)	+4 (+0.35)
A5	0	216	+216 (+5.38)	+1 (+0.43)	+0 (+0.01)	+0 (+0.35)
N1	0	350	+350 (+5.86)	+0 (+0.32)	-0 (-0.11)	+0 (+0.35)

Herons and Egrets

Abundance

Across all complexes, there were 3,275 total sightings of herons and egrets (sum sightings during the entire survey period). Compared to the previous year, this was an increase of 668 total sightings (+25.6%; Fig. 37). There were on average 218 more herons and egrets detected per survey in fall (Table A2.4), 28 more detected in winter (Table A2.6), and 88 more detected in spring (Table A2.8, Fig. 37).

At the pond level, A16 had the highest abundance (mean count of 50 per survey), followed by E2 (37) and N3A (32; Fig. 38). At these sites, we observed the majority of herons and egrets foraging (86.6%), foraging (70.7%), and foraging (83.8%), respectively (Table A4.9). Across all six surveys, the sites with the largest increases in herons and egrets from last year were E2 (+28 mean abundance per visit), N3A (+27), and N4AB (+23, while the sites with the largest decreases were A9 (-25), AB1 (-16), and E1 (-9; Fig. 39). Seasonal abundance of herons and egrets was exceptionally low (5th percentile) at AB1 (2 birds in spring).

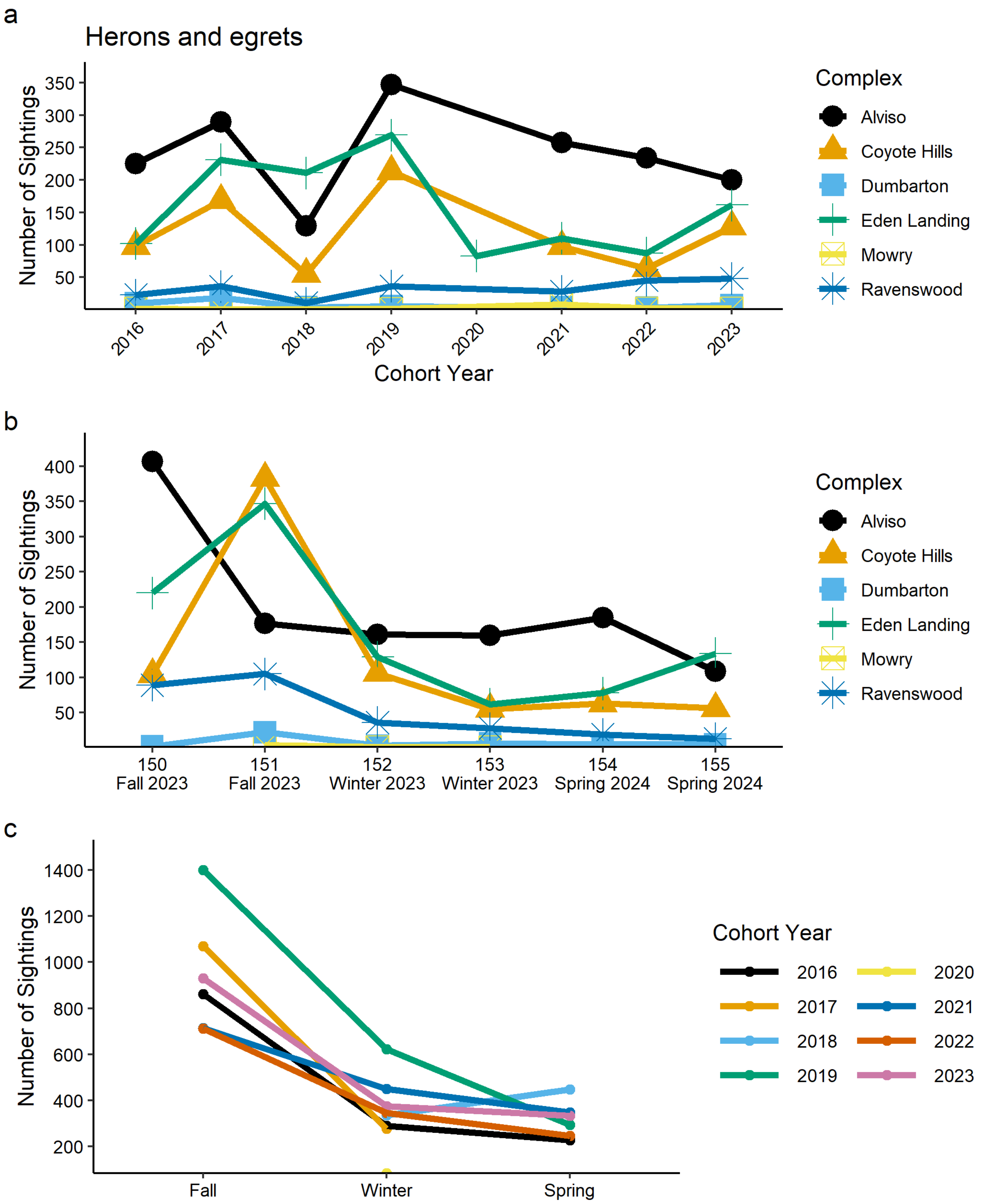

Figure 37. Abundance of herons and egrets by (a) study year (September to August of the following year) for each complex (averaged across surveys), (b) survey period for each complex during the current report period (September 2023 – May 2024), and (c) season for each study year at all salt production ponds combined; South San Francisco Bay, California, Sept. 2005 – May 2024 (averaged across surveys). Study years 2019 and 2020 contain incomplete survey rounds.

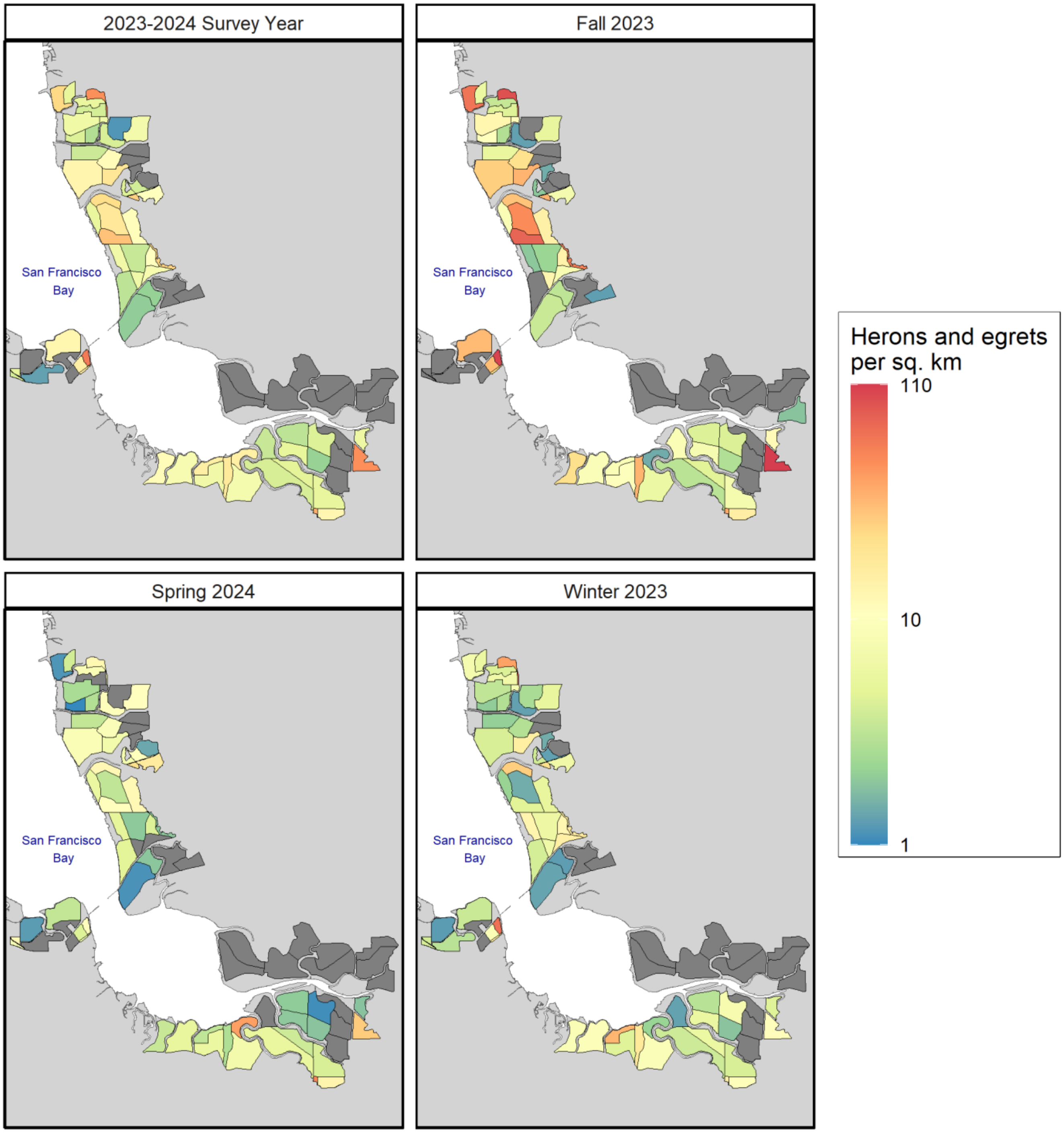

Figure 38. Density of herons and egrets averaged across survey rounds by season, South San Francisco Bay, California; September 2023–May 2024. Dark grey ponds had no birds.

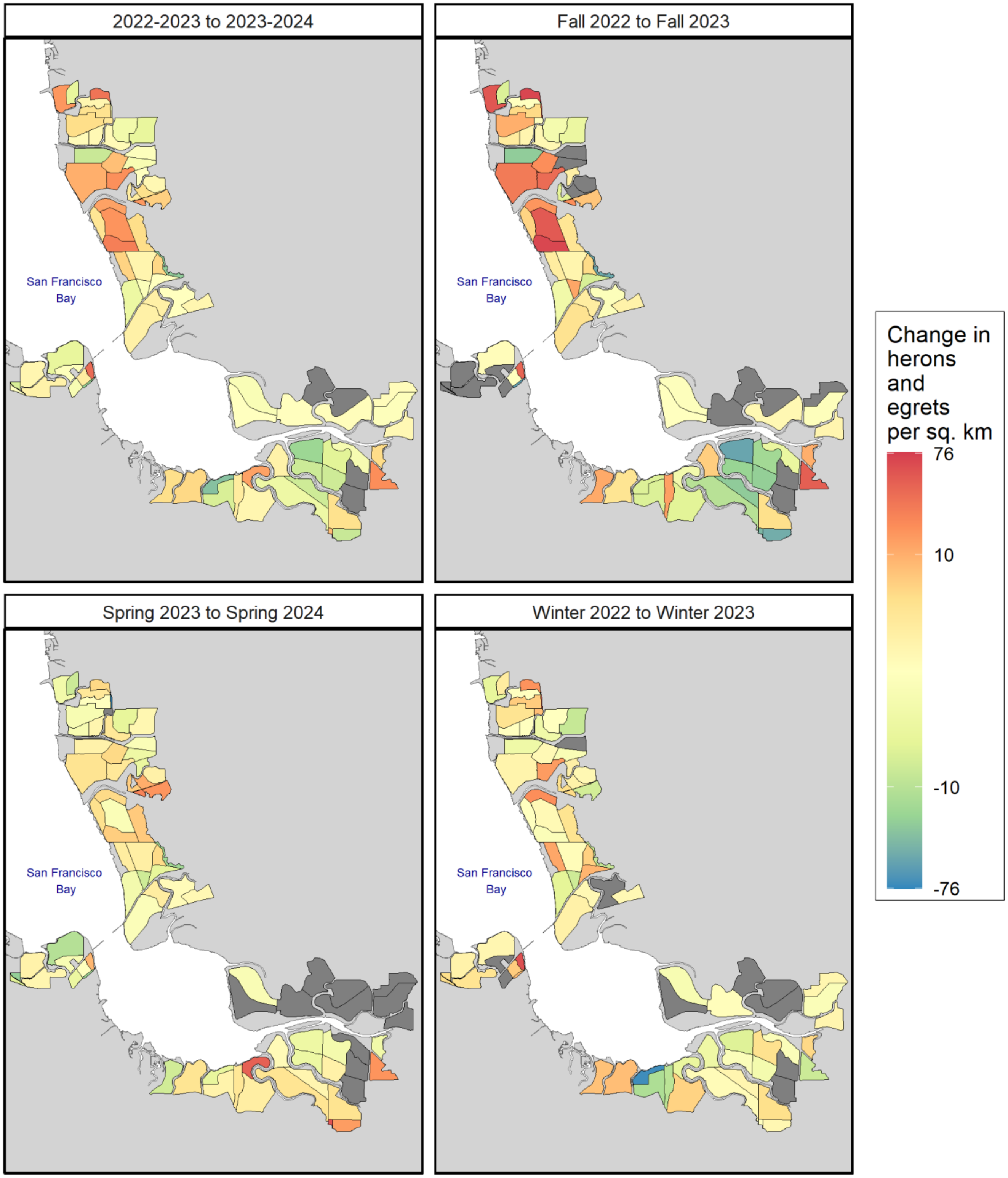

Figure 39. Interannual change in density of herons and egrets between September 2022–May 2023 and September 2023–May 2024 in pond habitats of South San Francisco Bay, California. Seasonal panels are density averaged across survey rounds by season, while the Overall panel is averaged across all six survey periods. Dark grey ponds had no birds during that seasonal window in both the current and previous year.

Trends and Trigger Status

No formal targets have been set for herons and egrets, but we still provide a comparison to a hypothetical management trigger based on baseline abundance for a more comprehensive assessment of waterbird populations within the South Bay. For herons and egrets in fall, this hypothetical trigger—two or more of the past three years of fall abundance below the 2005-2007 baseline value—was tripped this year because average seasonal abundance was below this threshold in all three of the three most recent years of complete surveys (Table 2). The estimated multi-year trend for average fall abundance of herons and egrets across the study area was -85 at the end of fall 2024. The trend within the SBSPRP-managed wildlife ponds (-1.54 per km^2, -43 total) was worse than the trend within the Cargill-managed salt ponds (-1.21 per km^2, -34 total). The trend within SBSPRP ponds that had been breached to restore tidal marsh was better than both the wildlife ponds and salt ponds (+0.04 per km^2, +1 total; Fig. 40).

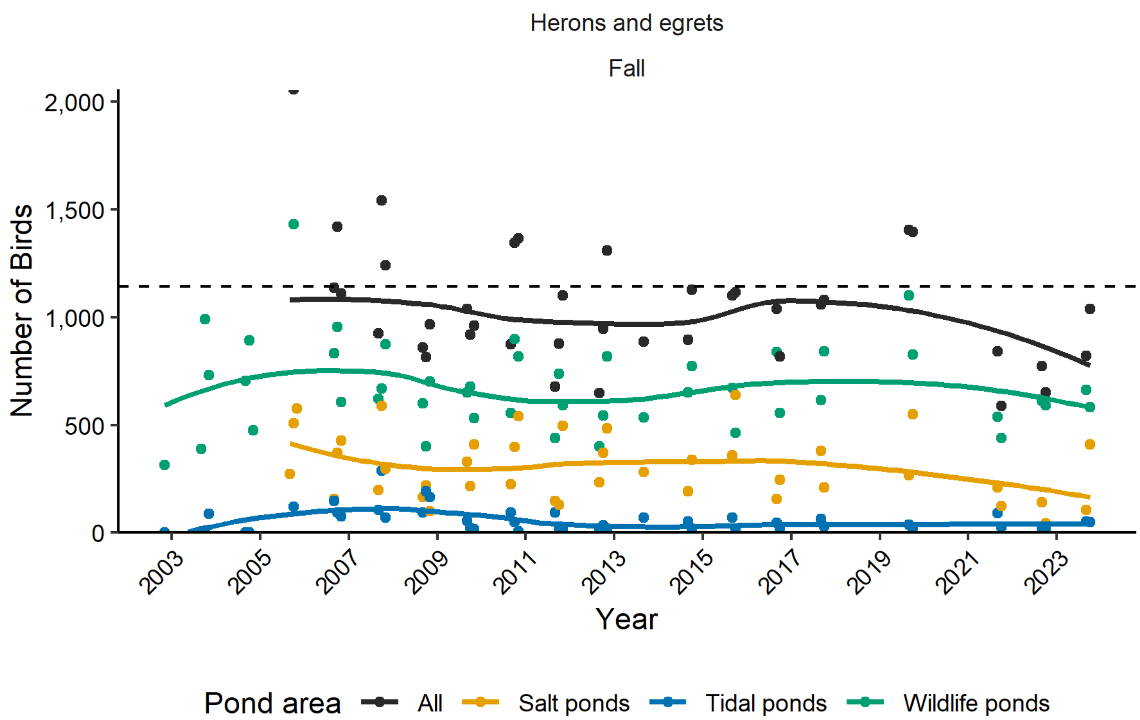

Figure 40. Counts of herons and egrets during target season(s) within the South Bay Salt Pond Restoration Project (SBSPRP) and salt production ponds. Lines represent LOESS curves and the dashed lines denote SBSPRP targets or baseline values (average counts from 2005-2007). Ponds A20, A21, A6N, and E10X were excluded from analysis because they were not surveyed after tidal restoration.

Phalaropes

Abundance

Across all complexes, there were 5,101 total sightings of phalaropes (sum sightings during the entire survey period). Compared to the previous year, this was an increase of 31 total sightings (+0.6%; Fig. 41). There were on average 581 fewer phalaropes detected per survey in fall (Table A2.4), 7 fewer detected in winter (Table A2.6), and 604 more detected in spring (Table A2.8, Fig. 41).

At the pond level, E13 had the highest abundance (mean count of 187 per survey), followed by E5 (174) and A5 (150; Fig. 42). At these sites, we observed the majority of phalaropes foraging (99.6%), foraging (100.0%), and foraging (78.0%), respectively (Table A4.10). Across all six surveys, the sites with the largest increases in phalaropes from last year were E13 (+187 mean abundance per visit), E5 (+174), and A5 (+150, while the sites with the largest decreases were E4 (-435), E2 (-169), and M2 (-69; Fig. 43). At A9 (339 birds in fall), E12 (205 in fall), E13 (560 in fall), and E5 (524 in fall), abundance of phalaropes was higher than ever previously recorded there.

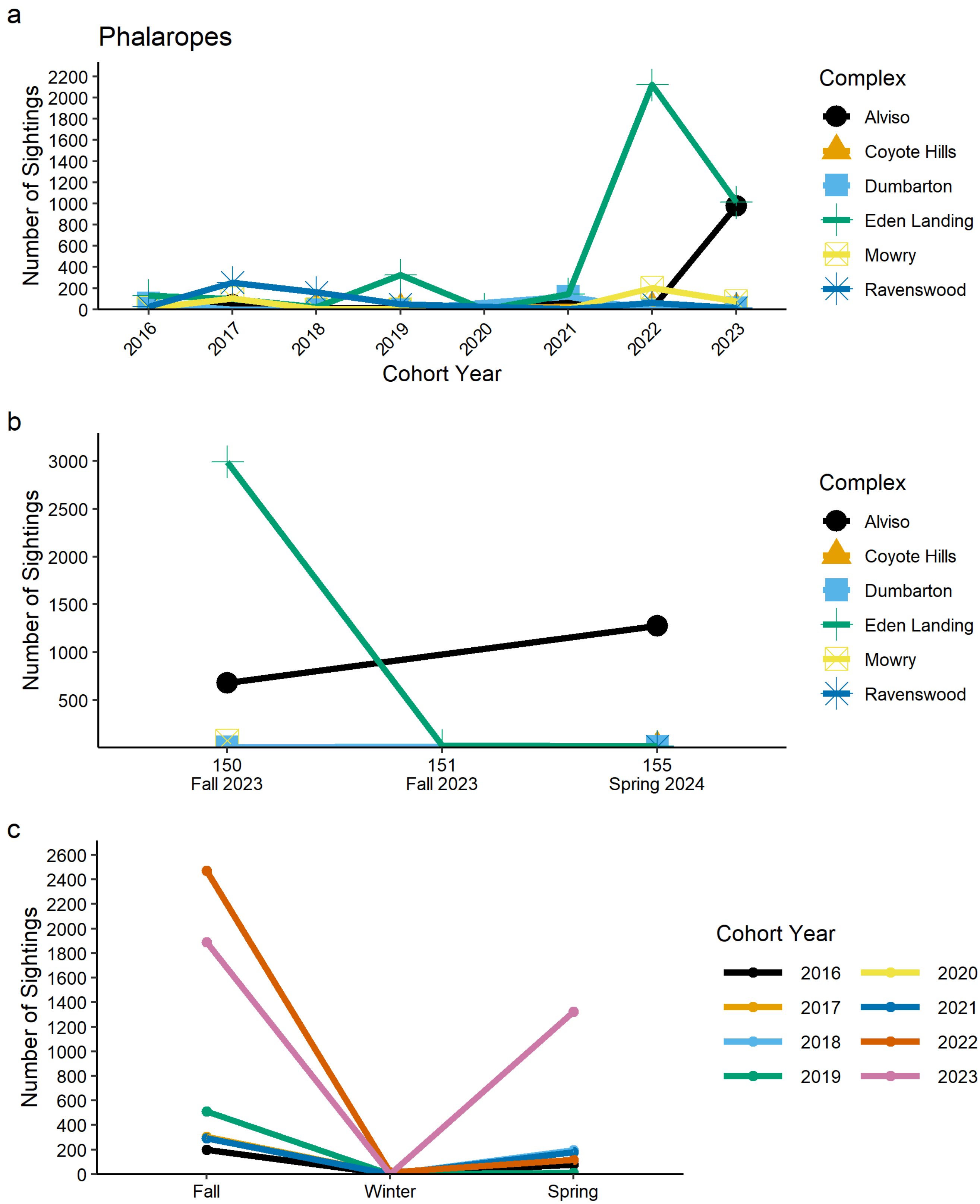

Figure 41. Abundance of phalaropes by (a) study year (September to August of the following year) for each complex (averaged across surveys), (b) survey period for each complex during the current report period (September 2023 – May 2024), and (c) season for each study year at all salt production ponds combined; South San Francisco Bay, California, Sept. 2005 – May 2024 (averaged across surveys). Study years 2019 and 2020 contain incomplete survey rounds.

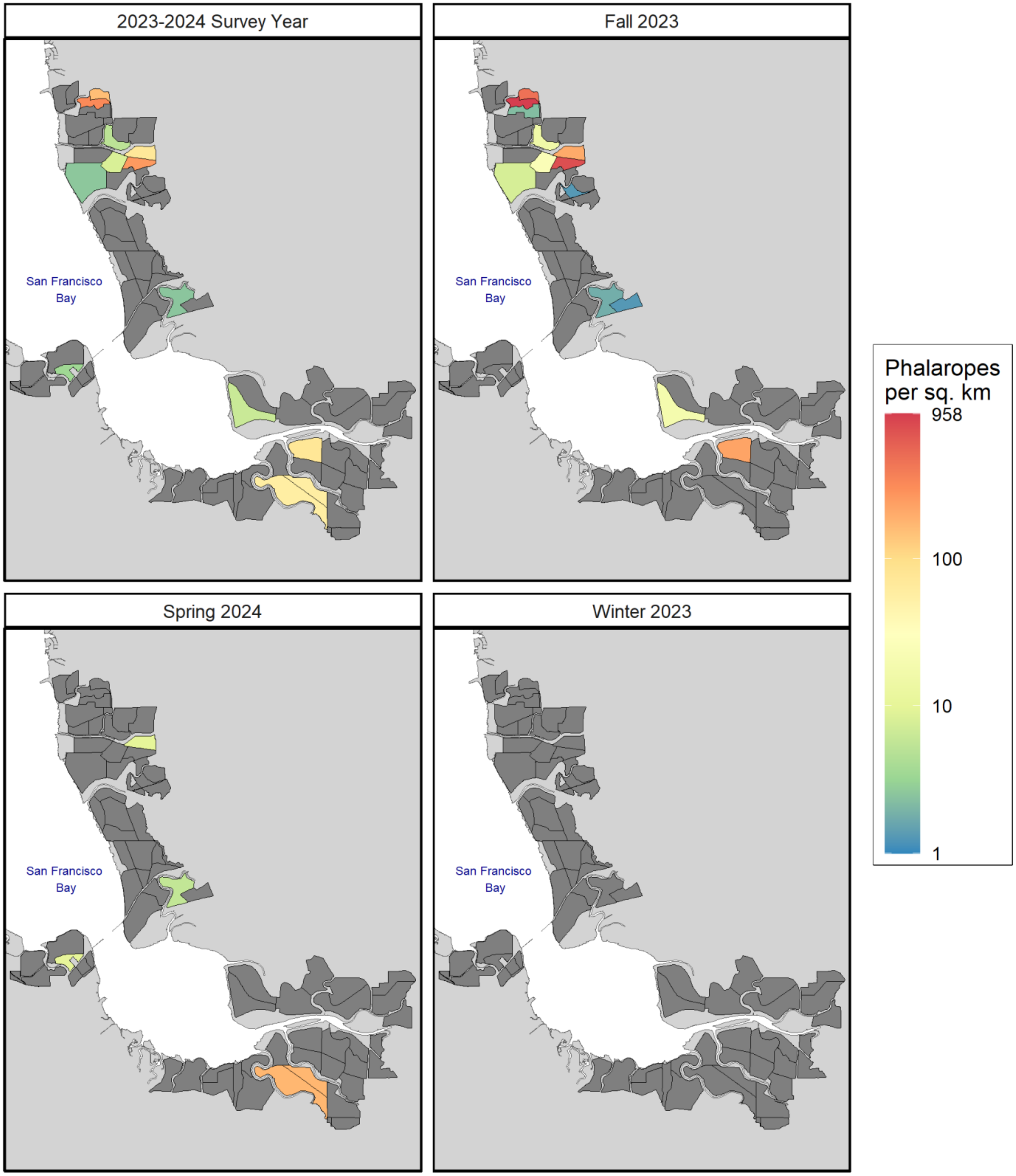

Figure 42. Density of phalaropes averaged across survey rounds by season, South San Francisco Bay, California; September 2023–May 2024. Dark grey ponds had no birds.

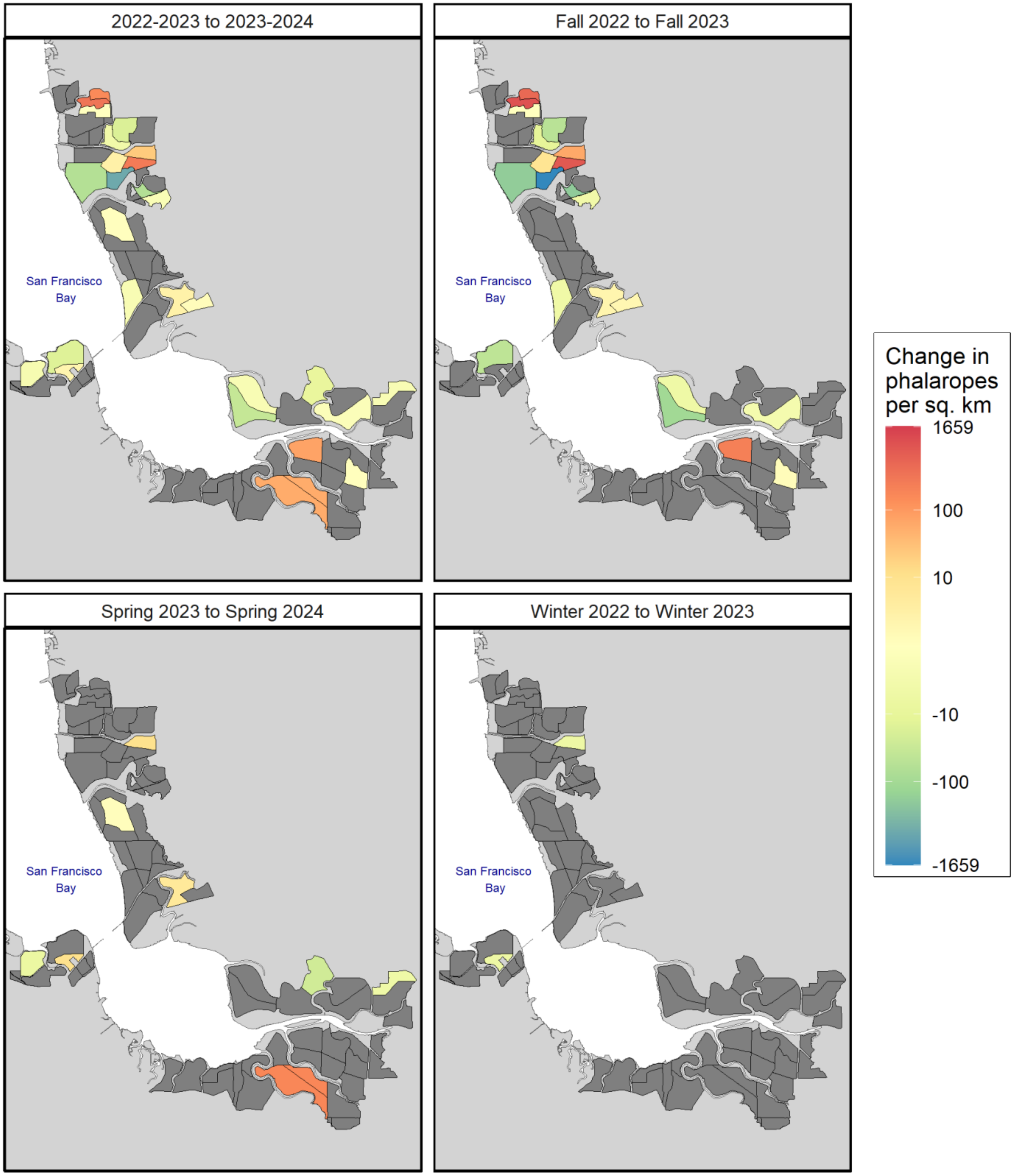

Figure 43. Interannual change in density of phalaropes between September 2022–May 2023 and September 2023–May 2024 in pond habitats of South San Francisco Bay, California. Seasonal panels are density averaged across survey rounds by season, while the Overall panel is averaged across all six survey periods. Dark grey ponds had no birds during that seasonal window in both the current and previous year.

Trends and Trigger Status

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; Tarjan 2021). The last year of general summer waterbird surveys was in 2017, at which time phalaropes exceeded their AMP trigger threshold with >50% declines in all three years 2015-2017 (Tarjan 2021). Since pond surveys are poorly timed to capture comparable counts during peak phalarope migration, we have conducted targeted phalarope migration surveys starting in 2019 (Burns et al. 2023). We advise using these targeted surveys rather than this report to draw conclusions about contemporary trends in phalarope population dynamics and design management plans to recover phalarope populations within South San Francisco Bay. In summer of 2023, within the SBSPRP and salt pond area the July–September 2023 survey round mean count was 1,974 birds, 62% below the revised baseline of 5,324. Therefore, counts remain worse than the 50% decline the single-year AMP trigger threshold for phalaropes (Van Schmidt & Parsons 2024).

Change Model

The phalarope dataset has low statistical power because of high variability in counts during their summer migration (Tarjan 2019b), resulting in several large average effect sizes which had low confidence. Despite this, the historical seasonal waterbird surveys still provide the best currently available dataset for understanding how phalaropes have responded to past habitat changes because the new targeted phalarope surveys only began in earnest in 2021 after their decline had already occurred. Neither of the previous studies of habitat relationships within South Bay assessed phalaropes (Scullen et al. 2013, De La Cruz et al. 2018).

Salinity was the only predictor of the observed decreases in phalarope populations with confidence intervals not overlapping zero—but surprisingly, decreases in salinity corresponded with increases in phalaropes, opposite of expectations (Fig. 44). This is likely because phalaropes exhibit higher rates of habitat use and foraging in marine to moderately hypersaline ponds (30 - 150 ppt salinity), rather than highly hypersaline ponds (>150 ppt), likely because the former have alkali flies while the latter are dominated by less nutritious brine shrimp (Van Schmidt & Parsons 2025, Rubega & Inouye 1994). Decreasing dissolved oxygen levels also increased phalaropes, as did decreasing water levels. A reduction in population growth one year after rainier years was supported in model selection, albeit weakly (Table A5.6). Lag effects of one year have also been seen in other migratory phalarope populations (Jehl et al. 1999). Time-lagged effects occur because influences on adult condition can take years to trickle down through juvenile recruitment to eventual population size (Metzger et al. 2009). Base model selection on site covariates found little support for any site covariates affecting change in abundance (Table A5.13).

We report predictions made by the change model within **6** ponds, excluding sites that were unoccupied by phalaropes in fall of both 2024 and 2023 (A1, A10, A11, A12, A13, A14, A15, A16, A17, A19, A22, A23, A2E, A2W, A3W, A5, A6S, A7, A8, A8S, A8W, A9, AB1, AB2, E1, E10, E11, E12, E14, E1C, E2, E2C, E3C, E4C, E5, E5C, E6A, E6B, E6C, E7, E8, E8AE, E8AW, E8X, E9, M2, M3, M5, M6, N1A, N2, N2A, N3, N3A, N4, N4AA, N4AB, N4B, N5, N6, N7, N8, N9, R2, R3, R4, R5, RS5, RSF2U1, RSF2U2, RSF2U3 and RSF2U4) and sites with missing water quality measurements (E6, M1 and M4). Across this set of sites, the actual change in abundance of phalaropes in fall was -359. In comparison, the model predicted a total change of -256, with this decrease driven by effects of weather. The proportion of variance in percent change in counts explained by the best model was low ($R^2c = 0.07$, $R^2m = 0.06$).

The change model estimated that changes in site hydrology could explain a 22 decrease in abundance of phalaropes from last year due to increasing salinity and/or increasing depth. The sites predicted to experience the largest increase in phalaropes abundance due to hydrology changes were E13, NPP1, and A3N, while the sites predicted to experience the largest increase in suitability (i.e., predicted percent change irrespective of actual abundance last year) were A3N, E13, and NPP1 (Table 10). The sites predicted to experience the largest negative impacts from changes in hydrology in fall 2024 were N1, E4, and R1 (based on predicted decreases in abundance) and E4, N1, and R1 (based on predicted decrease in suitability). No static site characteristics were included in the top model.

The change model predicted that deviations from mean weather could drive a 36 decrease in abundance due to high precipitation last year (Table 10). There was also a substantial amount of change in abundance attributable to the unexplained annual variability (the random year effect), with this term in 2024 decreasing abundance by 11, some of which is likely due to complex effects of weather not included in the model.

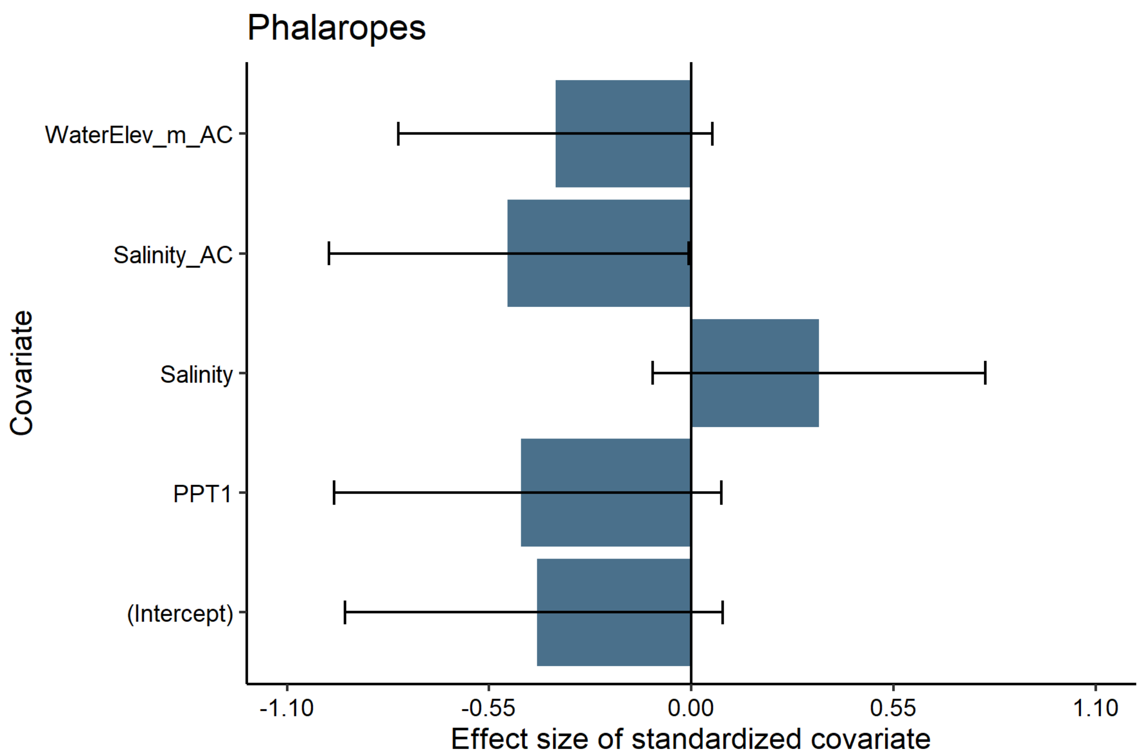

Figure 44. Fixed effects for the top model for interannual change in abundance of phalaropes during summer in current and former salt ponds in South San Francisco Bay, California, water year 2003–2024 (n = 233). Dark bars show coefficients and error bars show 95% confidence intervals.

Table 10. Actual and predicted changes in mean abundance per survey of phalaropes from fall 2022 to fall 2023 (sorted greatest decrease to greatest increase). Predicted effect sizes of covariate groups are shown for hydrology (salinity and depth; compared to no change from last year), weather (precipitation last year; compared to mean annual weather), and a year random effect. Change values were calculated by back-transforming the predictions on the ln(% change + 1) scale (shown in parentheses and interpretable as change in relative habitat suitability) and then multiplying by the actual previous year's abundance.

Pond	**Previous abun.**	**Current abun.**	**Actual change**	**Predicted change**	**Hydrology effect**	**Weather effect**	**Year effect**
N1	346	0	-346	-187	-23	-24	-7
			(-5.85)	(-0.77)	(-0.13)	(-0.14)	(-0.04)
NPP1	135	0	-135	-61	+1	-11	-3
			(-4.91)	(-0.59)	(+0.01)	(-0.13)	(-0.04)
E13	5	0	-5	-3	+1	-1	-0
			(-1.79)	(-0.67)	(+0.41)	(-0.25)	(-0.04)
E4	5	0	-5	-5	-1	-0	-0
			(-1.79)	(-1.81)	(-0.89)	(-0.20)	(-0.04)
A3N	0	2	+2	-0	+0	-0	-0
			(+1.10)	(-0.29)	(+0.44)	(-0.05)	(-0.04)
R1	0	130	+130	-0	-0	-0	-0
			(+4.88)	(-0.29)	(-0.11)	(-0.09)	(-0.04)

Medium Shorebirds

Abundance

Across all complexes, there were 91,685 total sightings of medium shorebirds (sum sightings during the entire survey period). Compared to the previous year, this was a decrease of 30,646 total sightings (-25.1%; Fig. 45). There were on average 9,842 fewer medium shorebirds detected per survey in fall (Table A2.4), 4,413 fewer detected in winter (Table A2.6), and 1,068 fewer detected in spring (Table A2.8, Fig. 45).

At the pond level, RSF2U1 had the highest abundance (mean count of 1,966 per survey), followed by A9 (1,146) and RSF2U2 (1,118; Fig. 46). At these sites, we observed the majority of medium shorebirds roosting on the pond (83.1%), roosting on the pond (65.6%), and roosting on islands (47.6%), respectively (Table A4.11). Across all six surveys, the sites with the largest increases in medium shorebirds from last year were RSF2U1 (+1,066 mean abundance per visit), AB1 (+525), and M3 (+284, while the sites with the largest decreases were E9 (-1,715), RSF2U2 (-1,319), and R1 (-963; Fig. 47). At E6C (664 birds in spring), abundance of medium shorebirds was higher than ever previously recorded there.

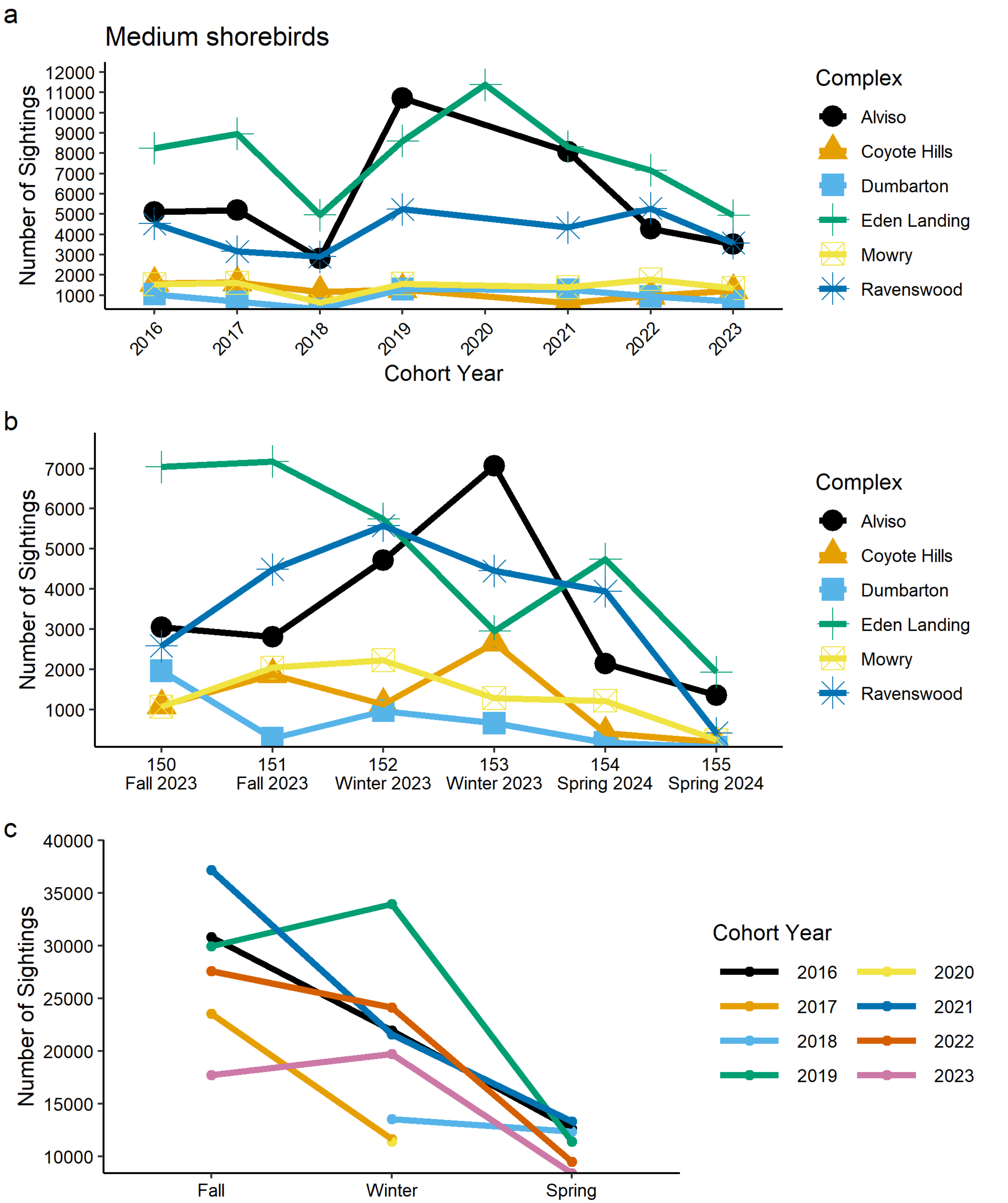

Figure 45. Abundance of medium shorebirds by (a) study year (September to August of the following year) for each complex (averaged across surveys), (b) survey period for each complex during the current report period (September 2023 – May 2024), and (c) season for each study year at all salt production ponds combined; South San Francisco Bay, California, Sept. 2005 – May 2024 (averaged across surveys). Study years 2019 and 2020 contain incomplete survey rounds.

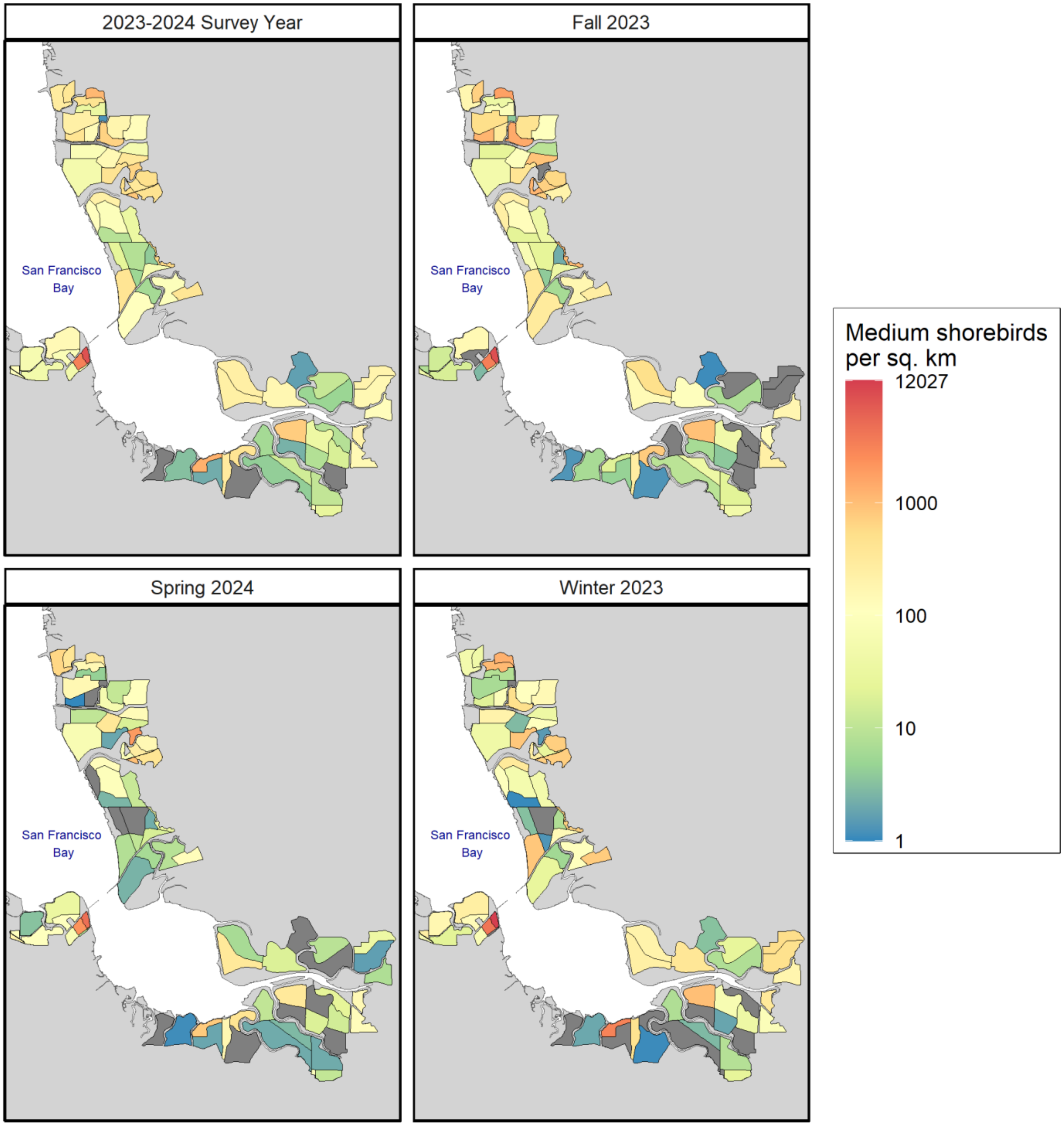

Figure 46. Density of medium shorebirds averaged across survey rounds by season, South San Francisco Bay, California; September 2023–May 2024. Dark grey ponds had no birds.

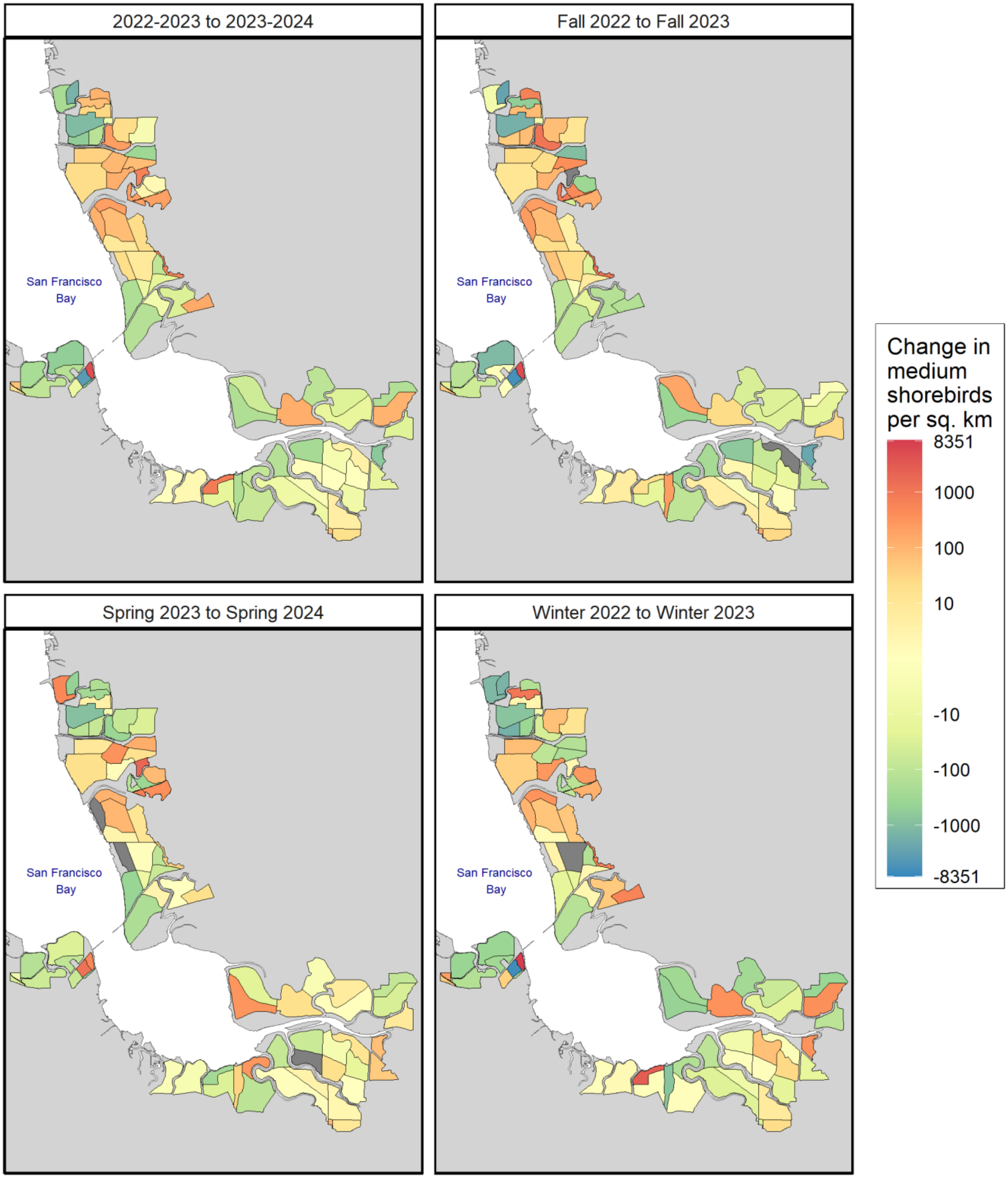

Figure 47. Interannual change in density of medium shorebirds between September 2022–May 2023 and September 2023–May 2024 in pond habitats of South San Francisco Bay, California. Seasonal panels are density averaged across survey rounds by season, while the Overall panel is averaged across all six survey periods. Dark grey ponds had no birds during that seasonal window in both the current and previous year.

Trends and Trigger Status

For medium shorebirds in winter, their management trigger—two or more of the past three years of winter abundance below the 2005-2007 baseline value—was tripped this year because average seasonal abundance was below this threshold in two of the three most recent years of complete surveys (Table 2). The estimated multi-year trend for average winter abundance of medium shorebirds across the study area was -1,047 at the end of winter 2024. The trend within the SBSPRP-managed wildlife ponds (-31.58 per km^2, -876 total) was worse than the trend within the Cargill-managed salt ponds (-6.09 per km^2, -169 total). The trend within SBSPRP ponds that had been breached to restore tidal marsh was in-between the wildlife ponds and salt ponds (-25.48 per km^2, -707 total; Fig. 48).

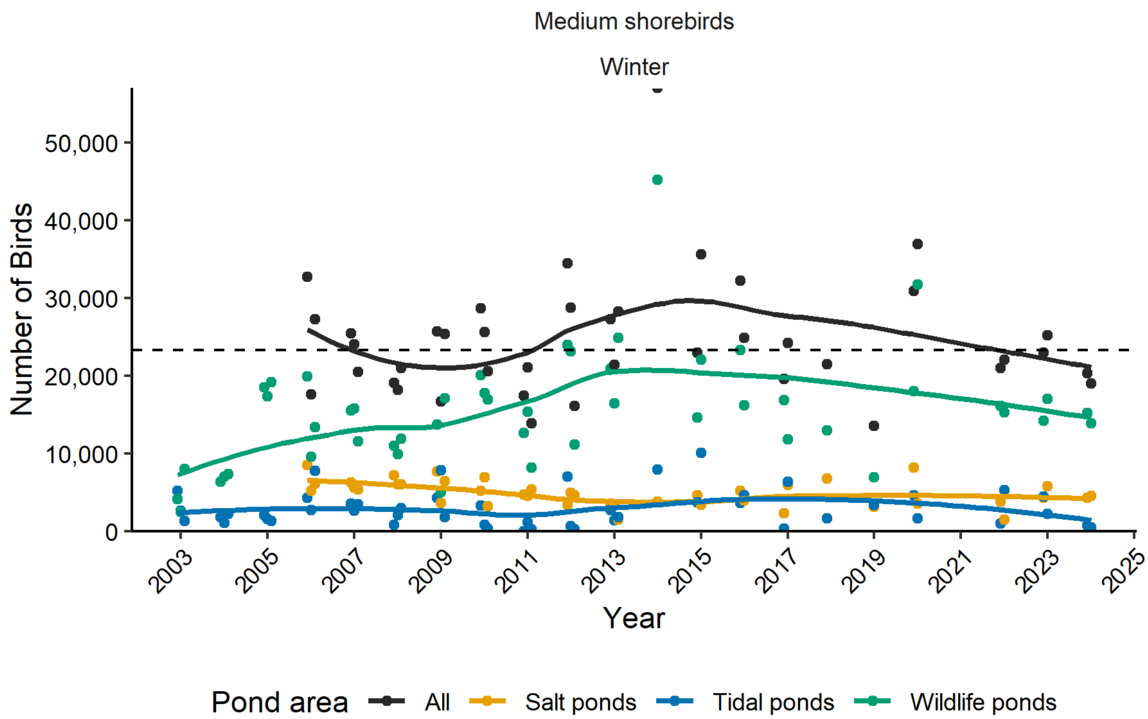

Figure 48. Counts of medium shorebirds during target season(s) within the South Bay Salt Pond Restoration Project (SBSPRP) and salt production ponds. Lines represent LOESS curves and the dashed lines denote SBSPRP targets or baseline values (average counts from 2005-2007). Ponds A20, A21, A6N, and E10X were excluded from analysis because they were not surveyed after tidal restoration.

Change Model

Reductions in water levels, which may expand the amount of mudflat or shallow water habitats for foraging, were the most significant predictor of changes in medium shorebird populations (Fig. 49). The largest effect was lower mean minimum temperatures during winter significantly predicting increases in abundance (Fig. 49). Conversely, greater year-to-date rain (Sept–Feb) correlated to reduced abundance, indicating negative impacts of storms or positive impacts of drought on abundance within South San Francisco Bay, but this covariate's confidence intervals overlapped zero. As seen in other guilds, decreasing salinity was a strong predictor of population growth of medium shorebirds. Negative relationships between change in percent abundance and both dissolved oxygen and change in dissolved oxygen were supported in model selection (Table A5.7), but had weak effects that overlapped zero (Fig. 49). As in other species/guilds, pond characteristics had little influence, but islands did weakly predict increasing abundance, as expected (De La Cruz et al. 2018). Previous reports showed that at the pond scale medium shorebirds were associated with widely varying topography and the presence of islands and levees for foraging and roosting, respectively (De La Cruz et al. 2018). Therefore, the presence of roosting islands or levees that are closed to public access and adjacent to quality foraging mudflat habitat are integral for medium shorebirds in ponds.

We report predictions made by the change model within 76 ponds, excluding sites that were unoccupied by medium shorebirds in winter of both 2024 and 2023 (N7) and sites with missing water quality measurements (A19, A8W, E8AE and E8AW). Across this set of sites, the actual change in abundance of medium shorebirds in winter was -3,672. In comparison, the model predicted a total change of +1,501, with this decrease driven by NA. The proportion of variance in percent change in counts explained by the best model was low ($R^2c = 0.05$, $R^2m = 0.02$).

The change model estimated that changes in site hydrology could explain a 397 increase in abundance of medium shorebirds from last year due to decreasing salinity and/or decreasing depth. The sites predicted to experience the largest increase in medium shorebirds abundance due to hydrology changes were M1, RSF2U1, and M2, while the sites predicted to experience the largest increase in suitability (i.e., predicted percent change irrespective of actual abundance last year) were N5, M1, and N9 (Table 11). The sites predicted to experience the largest negative impacts from changes in hydrology in winter 2024 were AB2, E10, and R4 (based on predicted decreases in abundance) and R4, E8X, and AB2 (based on predicted decrease in suitability). Static site characteristics (distance to creek and number of islands) accounted for an increase of 1,139 birds.

The change model predicted that deviations from mean weather could drive a 982 increase in abundance due to high maximum temperature (Table 11). There was also a substantial amount of change in abundance attributable to the unexplained annual variability (the random year effect), with this term in 2024 decreasing abundance by 2,540, some of which is likely due to complex effects of weather not included in the model.

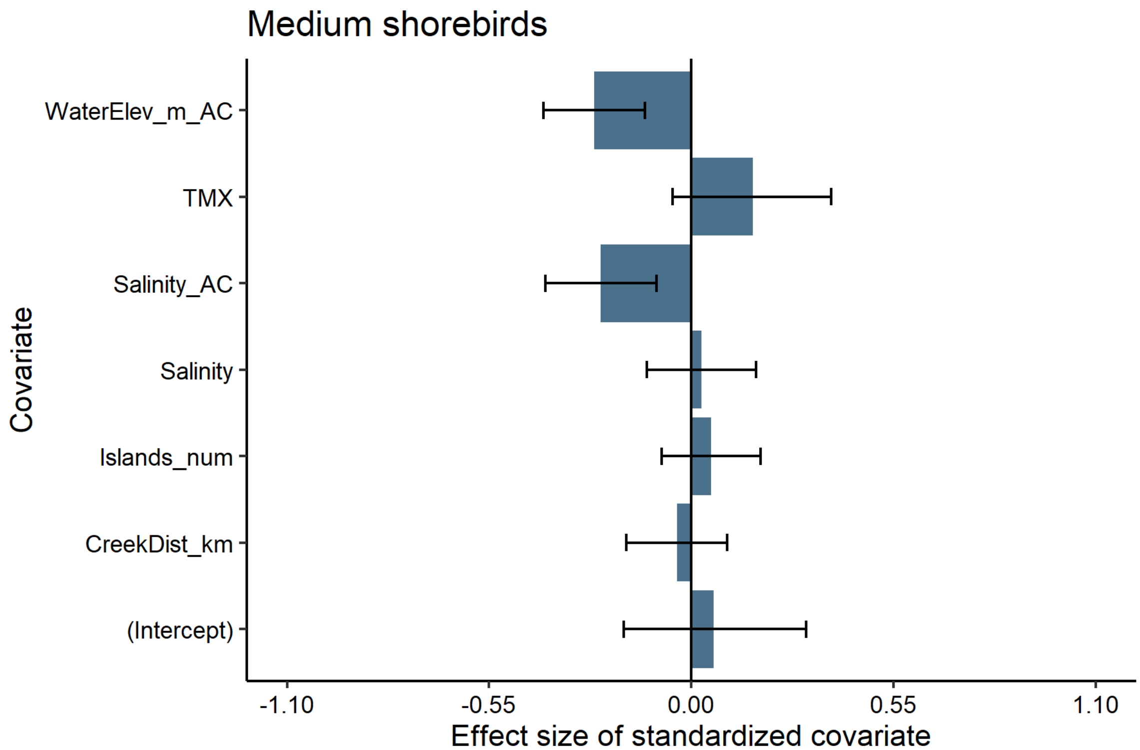

Figure 49. Fixed effects for the top model for interannual change in abundance of medium shorebirds during winter in current and former salt ponds in South San Francisco Bay, California, water year 2003–2024 (n = 1,283). Dark bars show coefficients and error bars show 95% confidence intervals.

Table 11. Actual and predicted changes in mean abundance per survey of medium shorebirds from winter 2023 to winter 2024 (sorted greatest decrease to greatest increase). Predicted effect sizes of covariate groups are shown for hydrology (salinity and depth; compared to no change from last year), weather (maximum temperature; compared to mean annual weather), static site characteristics (distance to creek and number of islands; compared to mean across all sites), and a year random effect. Change values were calculated by back-transforming the predictions on the ln(% change + 1) scale (shown in parentheses and interpretable as change in relative habitat suitability) and then multiplying by the actual previous year's abundance.

Pond	**Previous abun.**	**Current abun.**	**Actual change**	**Predicted change**	**Hydrology effect**	**Weather effect**	**Site effect**	**Year effect**
RSF2U2	3,770	1,420	-2,350 (-0.98)	+543 (+0.13)	-352 (-0.08)	-47 (-0.01)	+1,063 (+0.28)	-435 (-0.10)
E9	1,197	20	-1,177 (-4.04)	-34 (-0.03)	-37 (-0.03)	+45 (+0.04)	+26 (+0.02)	-117 (-0.10)
E10	1,098	91	-1,007 (-2.48)	-342 (-0.37)	-381 (-0.41)	+30 (+0.04)	+37 (+0.05)	-76 (-0.10)
M2	1,338	472	-866 (-1.04)	+438 (+0.28)	+339 (+0.21)	+119 (+0.07)	+83 (+0.05)	-179 (-0.10)
E11	742	22	-720 (-3.48)	+5 (+0.01)	-20 (-0.03)	+55 (+0.08)	+10 (+0.01)	-75 (-0.10)
R1	1,161	460	-702 (-0.93)	-185 (-0.17)	+9 (+0.01)	-3 (-0.00)	-128 (-0.12)	-99 (-0.10)
M1	1,024	406	-618 (-0.92)	+1,305 (+0.82)	+1,295 (+0.81)	+132 (+0.06)	-6 (-0.00)	-235 (-0.10)
AB2	904	336	-568 (-0.99)	-247 (-0.32)	-513 (-0.58)	+47 (+0.07)	+142 (+0.24)	-66 (-0.10)
M6	504	6	-498 (-4.28)	+25 (+0.05)	-21 (-0.04)	+40 (+0.08)	-5 (-0.01)	-53 (-0.10)
R4	690	204	-486 (-1.22)	-459 (-1.09)	-376 (-0.96)	+3 (+0.01)	-23 (-0.10)	-23 (-0.10)
A22	1,026	592	-434 (-0.55)	+163 (+0.15)	+100 (+0.09)	+130 (+0.12)	-13 (-0.01)	-120 (-0.10)
E5	398	142	-256 (-1.03)	+25 (+0.06)	+22 (+0.05)	+16 (+0.04)	-0 (-0.00)	-43 (-0.10)
A6S	256	8	-248 (-3.30)	-14 (-0.06)	-1 (-0.00)	+18 (+0.07)	-17 (-0.07)	-25 (-0.10)
N3	366	123	-244 (-1.09)	-3 (-0.01)	+11 (+0.03)	+10 (+0.03)	-9 (-0.03)	-37 (-0.10)
A3N	218	1	-217 (-4.70)	-7 (-0.03)	-2 (-0.01)	+15 (+0.07)	-10 (-0.05)	-21 (-0.10)
R3	200	25	-175 (-2.05)	-54 (-0.31)	-28 (-0.17)	+1 (+0.01)	-18 (-0.12)	-15 (-0.10)
R2	250	80	-171 (-1.14)	-43 (-0.19)	-3 (-0.01)	-2 (-0.01)	-29 (-0.13)	-21 (-0.10)
A5	147	2	-144 (-3.74)	+40 (+0.24)	+40 (+0.24)	+17 (+0.09)	-6 (-0.03)	-19 (-0.10)
N8	146	4	-142 (-3.49)	+76 (+0.42)	+82 (+0.46)	+10 (+0.05)	-9 (-0.04)	-22 (-0.10)
E6	150	59	-91 (-0.92)	-1 (-0.01)	-5 (-0.03)	+7 (+0.04)	+4 (+0.02)	-15 (-0.10)
E7	92	5	-88 (-2.75)	-3 (-0.04)	-3 (-0.04)	+2 (+0.02)	+3 (+0.04)	-9 (-0.10)
E12	628	562	-66 (-0.11)	-118 (-0.21)	-139 (-0.24)	+38 (+0.08)	+7 (+0.01)	-52 (-0.10)
M5	144	87	-56	-19	-44	+10	+8	-13

Pond	Previous abun.	Current abun.	Actual change	Predicted change	Hydrology effect	Weather effect	Site effect	Year effect
			(-0.50)	(-0.14)	(-0.30)	(+0.08)	(+0.07)	(-0.10)
E1C	112	65	-46 (-0.53)	-17 (-0.16)	-16 (-0.15)	+3 (+0.03)	+1 (+0.01)	-10 (-0.10)
A12	46	0	-46 (-3.85)	-5 (-0.12)	-11 (-0.24)	+4 (+0.11)	-2 (-0.05)	-4 (-0.10)
E5C	54	11	-43 (-1.52)	-9 (-0.18)	-9 (-0.18)	+2 (+0.05)	+0 (+0.00)	-5 (-0.10)
RSF2U4	37	0	-37 (-3.64)	-18 (-0.64)	-14 (-0.52)	-0 (-0.01)	-1 (-0.05)	-2 (-0.10)
E8	408	378	-30 (-0.08)	+9 (+0.02)	+21 (+0.05)	+8 (+0.02)	+4 (+0.01)	-42 (-0.10)
M4	54	33	-22 (-0.49)	-15 (-0.31)	-21 (-0.42)	+4 (+0.10)	+0 (+0.01)	-4 (-0.10)
N4	1,210	1,188	-22 (-0.02)	+68 (+0.06)	+232 (+0.20)	-5 (-0.00)	-125 (-0.09)	-129 (-0.10)
A16	102	86	-16 (-0.16)	+5 (+0.05)	-10 (-0.09)	+14 (+0.14)	+6 (+0.06)	-11 (-0.10)
E2C	93	83	-10 (-0.11)	-26 (-0.33)	-28 (-0.35)	+3 (+0.05)	+2 (+0.03)	-7 (-0.10)
A7	10	3	-7 (-1.01)	+0 (+0.04)	+0 (+0.01)	+1 (+0.10)	-0 (-0.01)	-1 (-0.10)
A9	1,500	1,494	-7 (-0.00)	+25 (+0.02)	-19 (-0.01)	+134 (+0.09)	-5 (-0.00)	-154 (-0.10)
N6	6	1	-5 (-1.25)	+1 (+0.08)	+1 (+0.16)	+0 (+0.05)	-1 (-0.07)	-1 (-0.10)
A15	4	1	-3 (-0.92)	-1 (-0.32)	-2 (-0.42)	+0 (+0.10)	+0 (+0.01)	-0 (-0.10)
A2E	2	0	-2 (-1.10)	+0 (+0.02)	+0 (+0.01)	+0 (+0.07)	-0 (-0.00)	-0 (-0.10)
E8X	1	0	-1 (-0.69)	-1 (-0.63)	-1 (-0.62)	+0 (+0.05)	-0 (-0.01)	-0 (-0.10)
A10	2	1	-0 (-0.22)	+0 (+0.01)	+0 (+0.00)	+0 (+0.09)	-0 (-0.02)	-0 (-0.10)
A1	0	1	+1 (+0.69)	-0 (-0.12)	-0 (-0.13)	+0 (+0.04)	+0 (+0.03)	-0 (-0.10)
A11	3	4	+1 (+0.22)	+0 (+0.02)	+0 (+0.01)	+0 (+0.09)	-0 (-0.03)	-0 (-0.10)
A3W	2	2	+1 (+0.34)	-0 (-0.07)	-0 (-0.04)	+0 (+0.07)	-0 (-0.04)	-0 (-0.10)
E6C	0	1	+1 (+0.69)	-0 (-0.23)	-0 (-0.25)	+0 (+0.05)	-0 (-0.01)	-0 (-0.10)
N9	76	76	+1 (+0.01)	+46 (+0.47)	+50 (+0.53)	+6 (+0.05)	-7 (-0.06)	-12 (-0.10)
N4AB	0	2	+2 (+1.10)	-0 (-0.14)	-0 (-0.04)	-0 (-0.02)	-0 (-0.03)	-0 (-0.10)
A2W	3	7	+4 (+0.69)	-0 (-0.03)	-0 (-0.07)	+0 (+0.04)	+0 (+0.06)	-0 (-0.10)
N5	0	5	+5 (+1.79)	+3 (+1.42)	+3 (+1.54)	-0 (-0.02)	-0 (-0.05)	-0 (-0.10)
RS5	4	8	+5 (+0.75)	-0 (-0.08)	-0 (-0.04)	+0 (+0.01)	+0 (+0.01)	-0 (-0.10)
N2	3	9	+6 (+0.92)	-0 (-0.09)	-0 (-0.06)	+0 (+0.05)	-0 (-0.04)	-0 (-0.10)
E14	4	11	+7 (+0.88)	+3 (+0.52)	+3 (+0.50)	+1 (+0.08)	+0 (+0.01)	-1 (-0.10)

Pond	Previous abun.	Current abun.	Actual change	Predicted change	Hydrology effect	Weather effect	Site effect	Year effect
RSF2U3	14	26	+13 (+0.64)	-1 (-0.09)	+0 (+0.01)	-0 (-0.01)	-1 (-0.05)	-1 (-0.10)
E6A	178	194	+16 (+0.09)	+2 (+0.01)	-3 (-0.02)	+9 (+0.05)	+7 (+0.04)	-18 (-0.10)
R5	8	30	+22 (+1.25)	-2 (-0.21)	-1 (-0.08)	+0 (+0.01)	-1 (-0.09)	-1 (-0.10)
A8	4	28	+24 (+1.76)	-0 (-0.02)	-0 (-0.00)	+1 (+0.12)	-0 (-0.07)	-0 (-0.10)
A8S	2	34	+32 (+2.46)	+0 (+0.05)	-0 (-0.01)	+0 (+0.12)	+0 (+0.01)	-0 (-0.10)
N4AA	4	63	+59 (+2.55)	+1 (+0.17)	+1 (+0.20)	+0 (+0.03)	-0 (-0.01)	-1 (-0.10)
N1	78	142	+64 (+0.60)	+9 (+0.11)	+15 (+0.18)	+4 (+0.05)	-7 (-0.08)	-9 (-0.10)
N2A	0	68	+68 (+4.24)	+0 (+0.05)	+0 (+0.11)	-0 (-0.01)	+0 (+0.00)	-0 (-0.10)
A13	14	84	+70 (+1.77)	-5 (-0.38)	-6 (-0.47)	+1 (+0.10)	+0 (+0.01)	-1 (-0.10)
E6B	52	128	+76 (+0.90)	+30 (+0.45)	+32 (+0.49)	+2 (+0.03)	-0 (-0.00)	-8 (-0.10)
E3C	418	494	+76 (+0.17)	-64 (-0.17)	-88 (-0.22)	+17 (+0.05)	+22 (+0.06)	-36 (-0.10)
E1	152	238	+86 (+0.44)	-43 (-0.33)	-41 (-0.32)	+2 (+0.02)	+3 (+0.03)	-11 (-0.10)
A14	7	94	+86 (+2.47)	+1 (+0.12)	+1 (+0.09)	+1 (+0.09)	-0 (-0.00)	-1 (-0.10)
E2	18	116	+97 (+1.79)	-4 (-0.20)	-5 (-0.26)	+0 (+0.02)	+1 (+0.09)	-2 (-0.10)
N4B	16	178	+162 (+2.35)	-2 (-0.10)	-1 (-0.04)	+1 (+0.05)	-1 (-0.04)	-2 (-0.10)
A17	1	184	+183 (+4.53)	+1 (+0.27)	+0 (+0.18)	+0 (+0.14)	+0 (+0.01)	-0 (-0.10)
N3A	2	188	+186 (+4.14)	-0 (-0.01)	+0 (+0.06)	-0 (-0.01)	-0 (-0.01)	-0 (-0.10)
E4C	338	530	+192 (+0.45)	+41 (+0.11)	+9 (+0.02)	+18 (+0.05)	+30 (+0.08)	-38 (-0.10)
N1A	2	218	+216 (+4.29)	-0 (-0.16)	-0 (-0.14)	+0 (+0.02)	+0 (+0.01)	-0 (-0.10)
E4	449	672	+222 (+0.40)	-76 (-0.19)	-90 (-0.22)	+7 (+0.02)	+21 (+0.06)	-38 (-0.10)
NPP1	142	602	+460 (+1.44)	-40 (-0.33)	-28 (-0.24)	+5 (+0.05)	-11 (-0.10)	-10 (-0.10)
E13	41	635	+594 (+2.72)	-2 (-0.04)	-2 (-0.06)	+3 (+0.08)	+0 (+0.00)	-4 (-0.10)
A23	189	880	+690 (+1.53)	+20 (+0.10)	-16 (-0.07)	+27 (+0.14)	+2 (+0.01)	-21 (-0.10)
M3	48	809	+762 (+2.82)	+4 (+0.07)	-6 (-0.11)	+4 (+0.09)	+5 (+0.11)	-5 (-0.10)
AB1	393	1,932	+1,538 (+1.59)	+62 (+0.15)	+52 (+0.12)	+26 (+0.06)	+12 (+0.03)	-46 (-0.10)
RSF2U1	844	2,762	+1,918 (+1.18)	+415 (+0.40)	+422 (+0.41)	-14 (-0.01)	+76 (+0.06)	-127 (-0.10)

Small Shorebirds

Abundance

Across all complexes, there were 281,014 total sightings of small shorebirds (sum sightings during the entire survey period). Compared to the previous year, this was a decrease of 260,259 total sightings (-48.1%; Fig. 50). In their target seasons of fall and spring their abundance changed by -48.3% and -37.3%, respectively. There were on average 51,242 fewer small shorebirds detected per survey in fall (Table A2.4), 52,789 fewer detected in winter (Table A2.6), and 26,099 fewer detected in spring (Table A2.8, Fig. 50).

At the pond level, R1 had the highest abundance (mean count of 8,527 per survey), followed by R2 (3,281) and E14 (2,975; Fig. 51). At these sites, we observed the majority of small shorebirds foraging (56.2%), roosting on the pond (64.5%), and foraging (84.5%), respectively (Table A4.12). Across all six surveys, the sites with the largest increases in small shorebirds from last year were R2 (+3,174 mean abundance per visit), M3 (+1,477), and M5 (+1,093, while the sites with the largest decreases were R1 (-11,557), A9 (-10,287), and E9 (-3,820; Fig. 52).

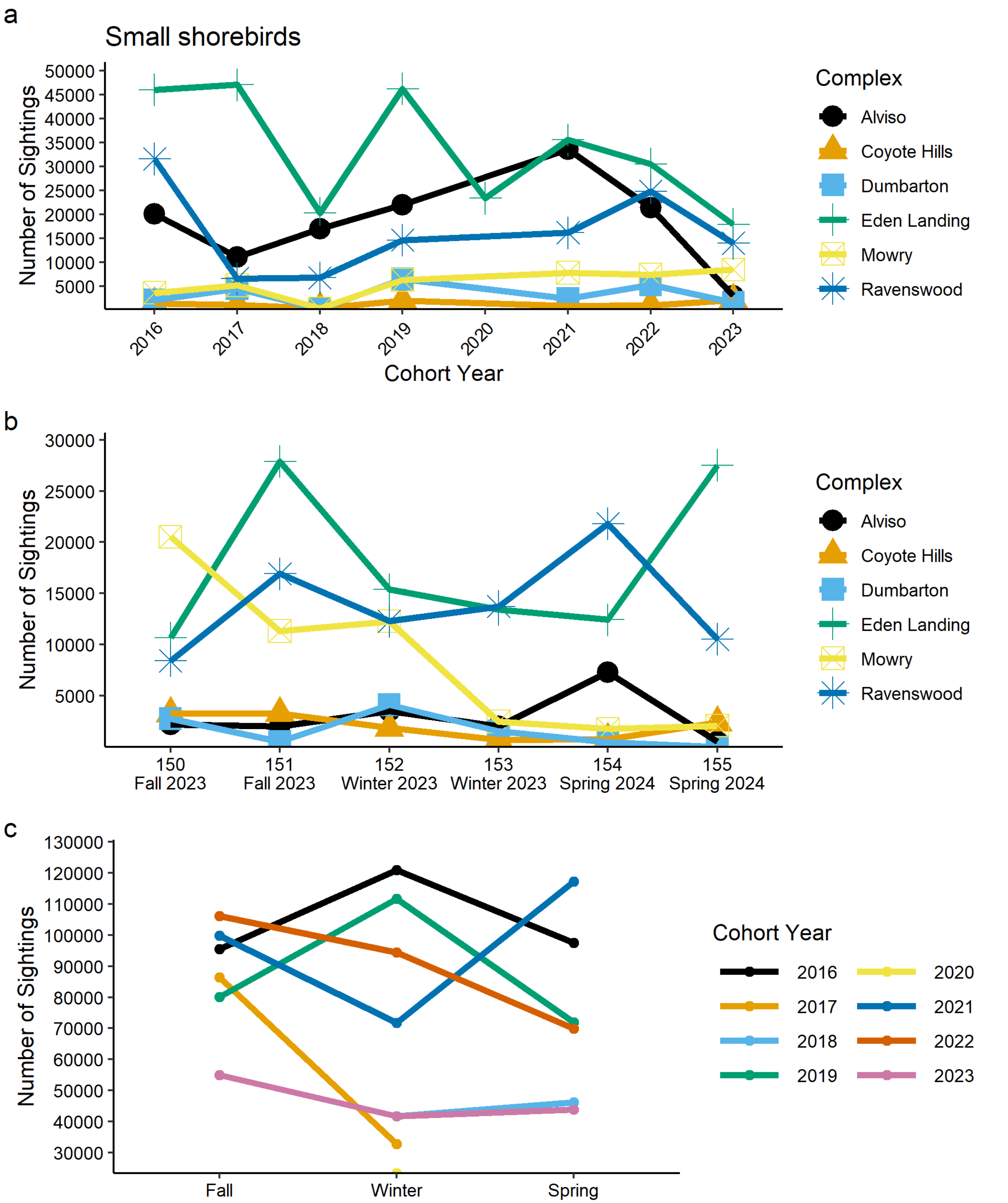

Figure 50. Abundance of small shorebirds by (a) study year (September to August of the following year) for each complex (averaged across surveys), (b) survey period for each complex during the current report period (September 2023 – May 2024), and (c) season for each study year at all salt production ponds combined; South San Francisco Bay, California, Sept. 2005 – May 2024 (averaged across surveys). Study years 2019 and 2020 contain incomplete survey rounds.

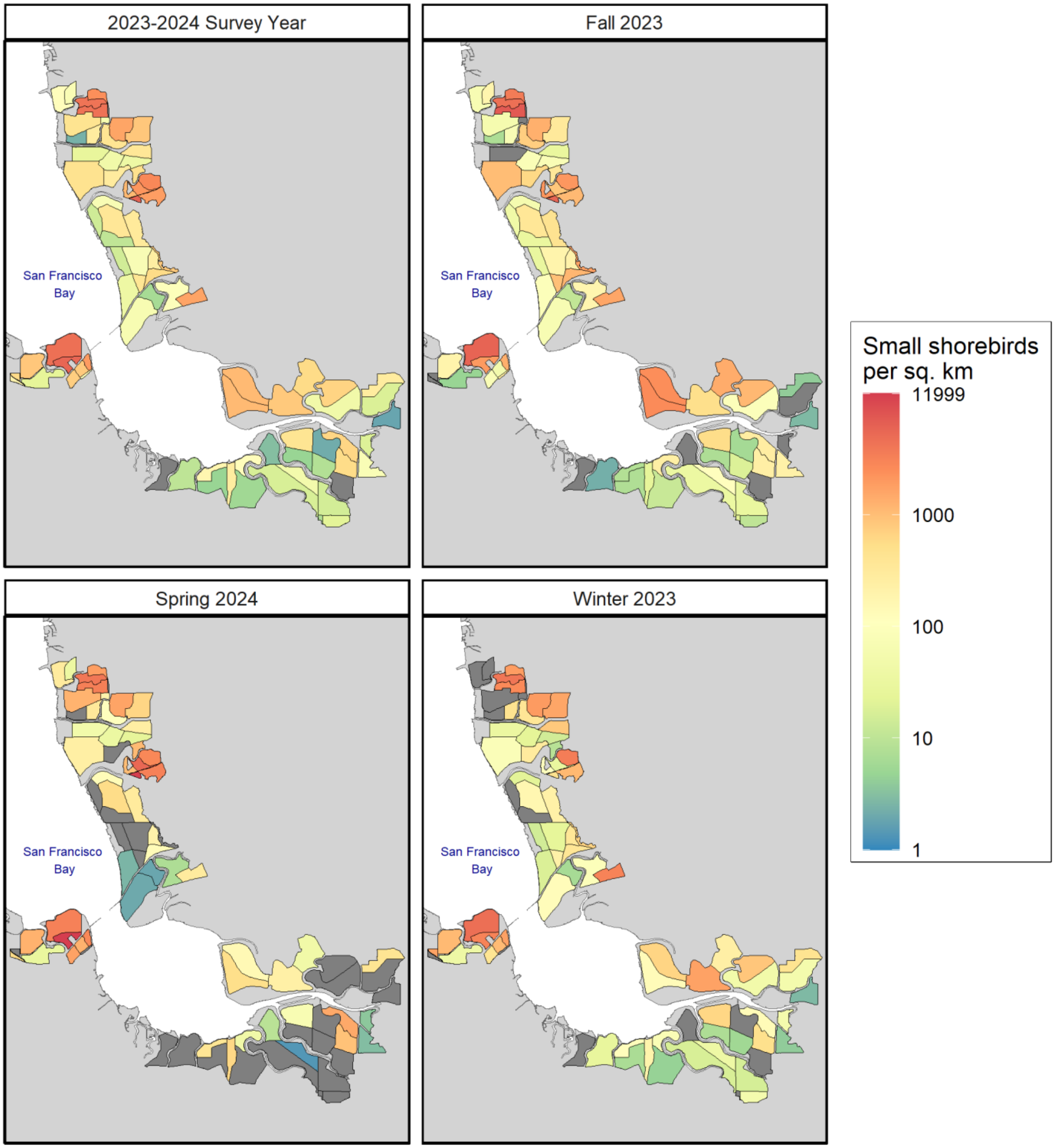

Figure 51. Density of small shorebirds averaged across survey rounds by season, South San Francisco Bay, California; September 2023–May 2024. Dark grey ponds had no birds.

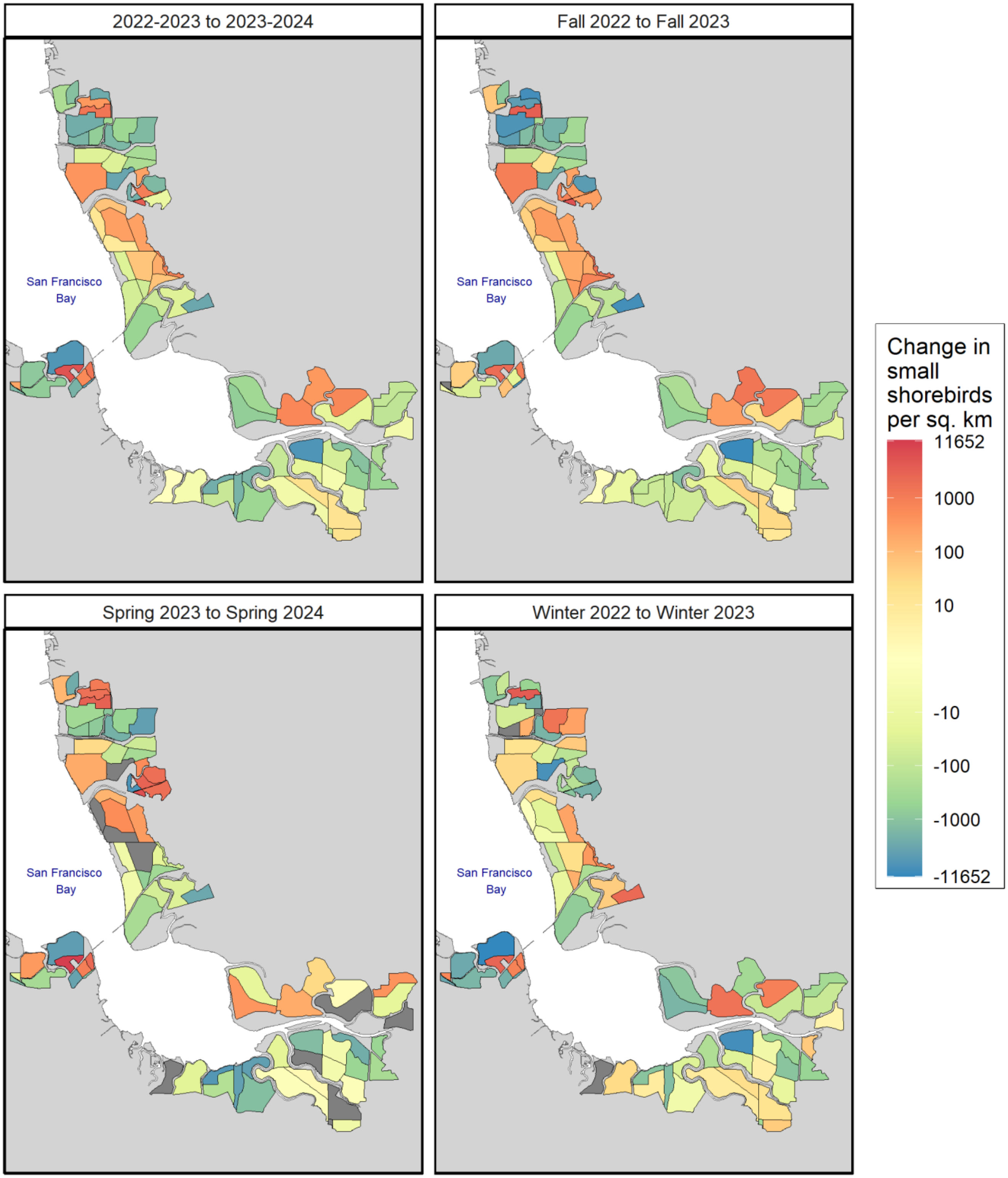

Figure 52. Interannual change in density of small shorebirds between September 2022–May 2023 and September 2023–May 2024 in pond habitats of South San Francisco Bay, California. Seasonal panels are density averaged across survey rounds by season, while the Overall panel is averaged across all six survey periods. Dark grey ponds had no birds during that seasonal window in both the current and previous year.

Trends and Trigger Status

For small shorebirds in fall, their management trigger—two or more of the past three years of fall abundance below the 2005-2007 baseline value—was not tripped this year because average seasonal abundance was below this threshold in one of the three most recent years of complete surveys (Table 2). The estimated multi-year trend for average fall abundance of small shorebirds across the study area was -6,286 at the end of fall 2024. The trend within the SBSPRP-managed wildlife ponds (-381.28 per km^2, -10,578 total) was worse than the trend within the Cargill-managed salt ponds (+97.09 per km^2, +2,694 total). The trend within SBSPRP ponds that had been breached to restore tidal marsh was in-between the wildlife ponds and salt ponds (+45.68 per km^2, +1,267 total; Fig. 53).

For small shorebirds in spring, their management trigger—two or more of the past three years of spring abundance below the 2005-2007 baseline value—was tripped this year because average seasonal abundance was below this threshold in two of the three most recent years of complete surveys (Table 2). The estimated multi-year trend for average spring abundance of small shorebirds across the study area was -7,956 at the end of spring 2024. The trend within the SBSPRP-managed wildlife ponds (-258.08 per km^2, -7,160 total) was worse than the trend within the Cargill-managed salt ponds (+15.35 per km^2, +426 total). The trend within SBSPRP ponds that had been breached to restore tidal marsh was in-between the wildlife ponds and salt ponds (-36.06 per km^2, -1,000 total; Fig. 53).

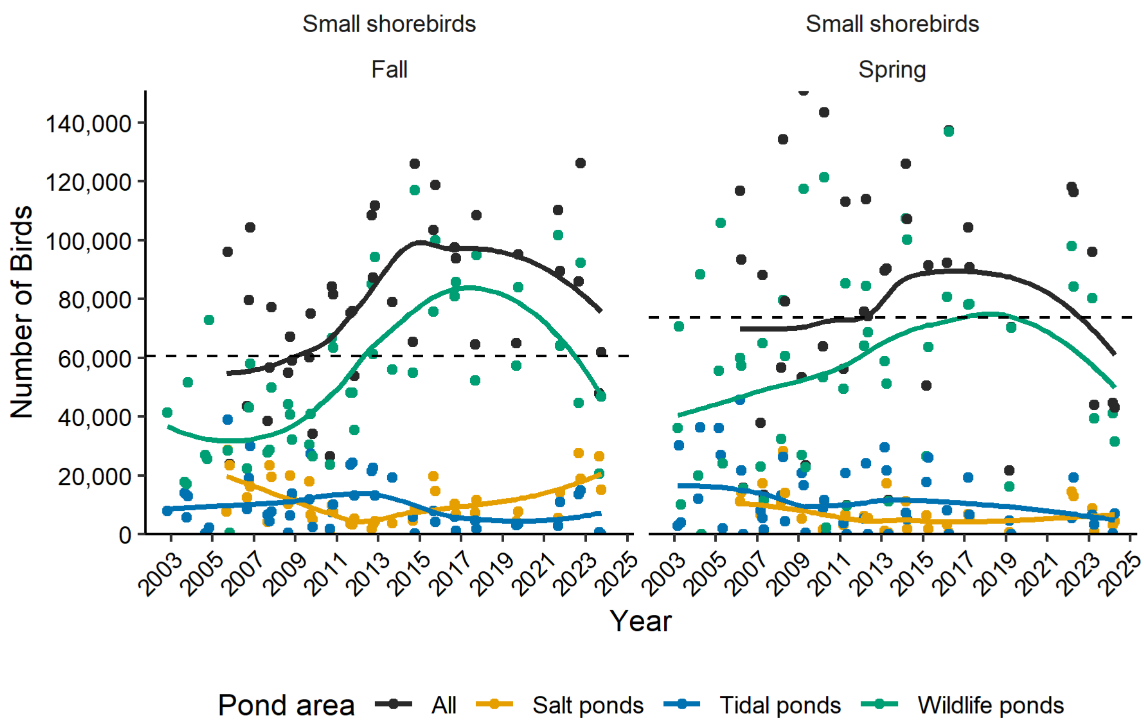

Figure 53. Counts of small shorebirds during target season(s) within the South Bay Salt Pond Restoration Project (SBSPRP) and salt production ponds. Lines represent LOESS curves and the dashed lines denote SBSPRP targets or baseline values (average counts from 2005-2007). Ponds A20, A21, A6N, and E10X were excluded from analysis because they were not surveyed after tidal restoration.

Change Model

We fit a single model for small shorebirds that encompassed both spring and fall migration periods, and found that spring migration had slightly higher population growth (Fig. 54). Surprisingly, we found that breached ponds had markedly larger population declines, which was the strongest effect though with very wide confidence intervals (Fig. 54). This contrasts with De La Cruz et al. (2018), who found small shorebirds had higher abundance in breached ponds. Results for small shorebirds were fairly consistent with those of medium shorebirds: decreasing water elevation was the most significant predictor of increases in small shorebird abundance during migration, but weather was also important. Small shorebirds showed negative effects of precipitation that were lagged up to three years, in line with findings of Warnock et al. (2021). Decreasing pond salinity was a strong predictor of increasing population size (Fig. 54), as seen in other guilds. This contrasts with Scullen et al. (2013), who found small shorebirds were more abundant at ponds with higher salinity and less abundant at ponds with higher pH. They also found higher abundance at ponds with warmer water. Results weakly supported that sites with closer proximity to creeks/sloughs showed increased growth (Fig. 54). Islands and levees in the ponds may offer high tide refugia for shorebirds in the San Francisco Bay (De La Cruz et al. 2018), though we did not find increasing abundance at sites with islands.

We report predictions made by the change model within 69 ponds, excluding sites that were unoccupied by small shorebirds in fall and spring of both 2024 and 2023 (A1, A10, A19, A8, A8W, E4, M4, N2A, N4AB and N7) and sites with missing water quality measurements (E8AE and E8AW). Because a single model was fit for small shorebirds from both fall and spring data with a dummy variable for season, we here report only predictions for the later spring season. Across this set of sites, the actual change in abundance of small shorebirds in spring was -37,255. In comparison, the model predicted a total change of -44,299, with this decrease driven by effects of static site characteristics. The proportion of variance in percent change in counts explained by the best model was low ($R^2c = 0.07$, $R^2m = 0.02$).

The change model estimated that changes in site hydrology could explain a 4,141 increase in abundance of small shorebirds from last year due to decreasing breached, decreasing salinity, and/or decreasing depth. The sites predicted to experience the largest increase in small shorebirds abundance due to hydrology changes were E2C, E9, and AB2, while the sites predicted to experience the largest increase in suitability (i.e., predicted percent change irrespective of actual abundance last year) were N5, E2C, and E9 (Table 12). The sites predicted to experience the largest negative impacts from changes in hydrology in spring 2024 were AB1, A3W, and A15 (based on predicted decreases in abundance) and A3W, AB1, and E13 (based on predicted decrease in suitability). Static site characteristics (distance to creek, number of islands, and public access) accounted for a decrease of 98 birds.

The change model predicted that deviations from mean weather could drive a 10,868 increase in abundance due to low precipitation in the last three years (Table 12). There was also a substantial amount of change in abundance attributable to the unexplained annual variability (the random year effect), with this term in 2024 decreasing abundance by 90,973, some of which is likely due to complex effects of weather not included in the model.

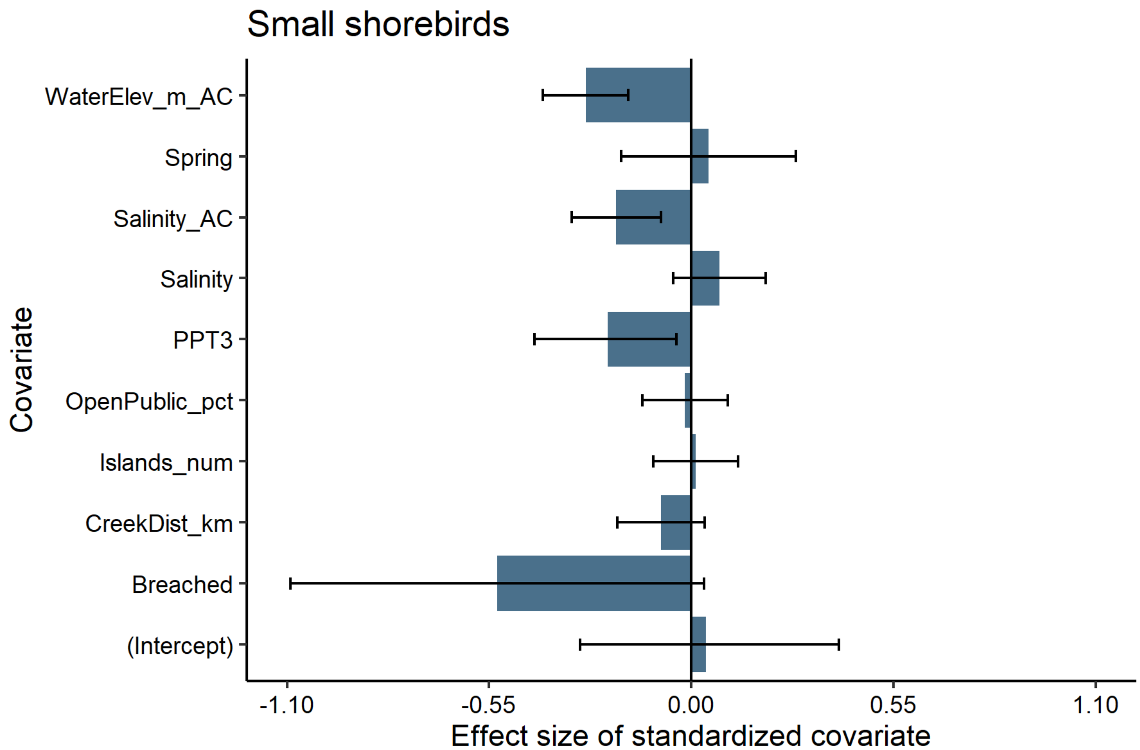

Figure 54. Fixed effects for the top model for interannual change in abundance of small shorebirds during fall and spring in current and former salt ponds in South San Francisco Bay, California, water year 2003–2024 (n = 2,158). Dark bars show coefficients and error bars show 95% confidence intervals.

Table 12. Actual and predicted changes in mean abundance per survey of small shorebirds from spring 2023 to spring 2024 (sorted greatest decrease to greatest increase). Predicted effect sizes of covariate groups are shown for hydrology (breached, salinity, and depth; compared to no change from last year), weather (precipitation in the last three years; compared to mean annual weather), static site characteristics (distance to creek, number of islands, and public access; compared to mean across all sites), and a year random effect. Change values were calculated by back-transforming the predictions on the ln(% change + 1) scale (shown in parentheses and interpretable as change in relative habitat suitability) and then multiplying by the actual previous year's abundance.

Pond	Previous abun.	Current abun.	Actual change	Predicted change	Hydrology effect	Weather effect	Site effect	Year effect
R1	14,254	5,916	-8,338 (-0.88)	-9,367 (-1.07)	-49 (-0.01)	+1,395 (+0.34)	-1,073 (-0.20)	-11,501 (-1.21)
AB2	7,302	907	-6,395 (-2.08)	-2,985 (-0.53)	+988 (+0.26)	+1,258 (+0.34)	+300 (+0.07)	-10,160 (-1.21)
A3N	6,010	60	-5,950 (-4.59)	-3,474 (-0.86)	+48 (+0.02)	+737 (+0.34)	-110 (-0.04)	-5,970 (-1.21)
E6A	6,484	830	-5,654 (-2.05)	-3,412 (-0.75)	+187 (+0.06)	+831 (+0.32)	+233 (+0.08)	-7,232 (-1.21)
E1C	4,310	262	-4,048 (-2.80)	-2,097 (-0.67)	+265 (+0.13)	+606 (+0.32)	+153 (+0.07)	-5,208 (-1.21)
AB1	4,021	242	-3,778 (-2.80)	-2,944 (-1.32)	-742 (-0.52)	+314 (+0.34)	+76 (+0.07)	-2,537 (-1.21)
A3W	2,800	0	-2,800 (-7.94)	-2,342 (-1.81)	-688 (-0.92)	+134 (+0.34)	-21 (-0.05)	-1,079 (-1.21)
E11	2,637	18	-2,620 (-4.96)	-1,224 (-0.62)	+229 (+0.18)	+378 (+0.31)	+118 (+0.09)	-3,326 (-1.21)
A15	4,174	1,587	-2,586 (-0.97)	-2,455 (-0.89)	-317 (-0.17)	+503 (+0.35)	+12 (+0.01)	-4,045 (-1.21)
NPP1	2,638	230	-2,409 (-2.44)	-1,683 (-1.02)	-47 (-0.05)	+268 (+0.33)	-202 (-0.19)	-2,249 (-1.21)
A9	2,139	104	-2,036 (-3.02)	-1,286 (-0.92)	-68 (-0.08)	+247 (+0.34)	+16 (+0.02)	-2,009 (-1.21)
E8	1,725	155	-1,570 (-2.40)	-848 (-0.68)	+107 (+0.13)	+238 (+0.32)	+65 (+0.08)	-2,066 (-1.21)
RSF2U3	1,984	629	-1,356 (-1.15)	-915 (-0.62)	+259 (+0.28)	+308 (+0.34)	-89 (-0.08)	-2,519 (-1.21)
N3	620	9	-611 (-4.13)	-370 (-0.91)	+29 (+0.12)	+70 (+0.33)	-54 (-0.20)	-589 (-1.21)
E6B	2,490	1,899	-590 (-0.27)	-1,061 (-0.55)	+350 (+0.28)	+387 (+0.32)	+71 (+0.05)	-3,364 (-1.21)
E9	2,466	1,904	-561 (-0.26)	-771 (-0.37)	+1,066 (+0.99)	+457 (+0.31)	+79 (+0.05)	-3,989 (-1.21)
A13	1,568	1,034	-533 (-0.42)	-888 (-0.83)	-56 (-0.08)	+199 (+0.35)	-4 (-0.01)	-1,601 (-1.21)
A17	520	4	-516 (-4.65)	-219 (-0.54)	+166 (+0.79)	+89 (+0.35)	+17 (+0.06)	-711 (-1.21)
E5	455	33	-422 (-2.60)	-240 (-0.75)	+13 (+0.06)	+59 (+0.32)	+12 (+0.06)	-509 (-1.21)
R3	381	67	-314 (-1.73)	-171 (-0.59)	+59 (+0.33)	+60 (+0.34)	-42 (-0.18)	-497 (-1.21)
A16	282	3	-279	-179	-11	+31	-4	-245

Pond	Previous abun.	Current abun.	Actual change	Predicted change	Hydrology effect	Weather effect	Site effect	Year effect
			(-4.26)	(-1.00)	(-0.10)	(+0.35)	(-0.03)	(-1.21)
N6	245	0	-245	-122	+28	+35	-11	-292
			(-5.51)	(-0.68)	(+0.26)	(+0.33)	(-0.08)	(-1.21)
A2E	232	0	-232	-132	-1	+29	+2	-237
			(-5.45)	(-0.84)	(-0.01)	(+0.34)	(+0.02)	(-1.21)
N9	276	75	-202	-127	+41	+42	-11	-354
			(-1.30)	(-0.61)	(+0.32)	(+0.33)	(-0.07)	(-1.21)
RS5	277	140	-137	-156	-3	+35	+5	-287
			(-0.68)	(-0.82)	(-0.02)	(+0.33)	(+0.04)	(-1.21)
E8X	145	25	-120	-119	-10	+7	+1	-63
			(-1.73)	(-1.70)	(-0.32)	(+0.31)	(+0.04)	(-1.21)
N1	113	20	-93	-75	-4	+11	-7	-92
			(-1.69)	(-1.07)	(-0.09)	(+0.33)	(-0.16)	(-1.21)
RSF2U4	75	0	-75	-46	-0	+9	-2	-71
			(-4.33)	(-0.92)	(-0.01)	(+0.34)	(-0.06)	(-1.21)
M1	665	592	-73	-43	+313	+179	-3	-1,467
			(-0.12)	(-0.07)	(+0.70)	(+0.34)	(-0.00)	(-1.21)
E7	102	30	-72	-59	-2	+12	+3	-105
			(-1.21)	(-0.85)	(-0.05)	(+0.32)	(+0.08)	(-1.21)
A23	66	0	-66	-35	-4	+9	+2	-75
			(-4.20)	(-0.75)	(-0.12)	(+0.35)	(+0.08)	(-1.21)
E6	256	204	-52	-144	-5	+30	+9	-264
			(-0.22)	(-0.83)	(-0.04)	(+0.32)	(+0.08)	(-1.21)
A6S	72	21	-51	-57	-0	+5	-1	-39
			(-1.20)	(-1.49)	(-0.01)	(+0.34)	(-0.08)	(-1.21)
A2W	48	0	-48	-25	+2	+7	+2	-58
			(-3.89)	(-0.69)	(+0.08)	(+0.34)	(+0.09)	(-1.21)
N2	39	3	-36	-21	+4	+5	-3	-46
			(-2.30)	(-0.72)	(+0.24)	(+0.33)	(-0.13)	(-1.21)
N4	22	7	-15	-10	+5	+4	-2	-31
			(-1.06)	(-0.56)	(+0.44)	(+0.33)	(-0.16)	(-1.21)
N4B	12	0	-12	-8	-0	+1	-0	-13
			(-2.60)	(-0.92)	(-0.03)	(+0.33)	(-0.03)	(-1.21)
E6C	385	373	-12	-200	+17	+51	+6	-438
			(-0.03)	(-0.73)	(+0.10)	(+0.32)	(+0.04)	(-1.21)
A14	11	0	-11	-4	+3	+2	+0	-19
			(-2.48)	(-0.38)	(+0.46)	(+0.35)	(+0.02)	(-1.21)
N5	10	0	-10	+139	+146	+42	-14	-353
			(-2.40)	(+2.61)	(+3.55)	(+0.33)	(-0.09)	(-1.21)
A11	9	0	-9	-6	-0	+1	-0	-10
			(-2.30)	(-0.88)	(-0.01)	(+0.35)	(-0.02)	(-1.21)
A8S	9	0	-9	-5	-0	+1	+0	-11
			(-2.30)	(-0.80)	(-0.00)	(+0.35)	(+0.08)	(-1.21)
A5	6	0	-6	-4	-0	+1	-0	-6
			(-1.95)	(-0.94)	(-0.04)	(+0.34)	(-0.03)	(-1.21)
A12	3	0	-3	-2	-0	+1	-0	-5
			(-1.39)	(-0.70)	(-0.02)	(+0.35)	(-0.08)	(-1.21)
R5	3	0	-3	-3	-0	+0	-0	-3
			(-1.39)	(-1.00)	(-0.01)	(+0.33)	(-0.14)	(-1.21)
M5	0	2	+2	-1	-0	+0	+0	-1
			(+1.10)	(-0.80)	(-0.14)	(+0.34)	(+0.05)	(-1.21)

Pond	Previous abun.	Current abun.	Actual change	Predicted change	Hydrology effect	Weather effect	Site effect	Year effect
A7	0	3	+3 (+1.39)	-1 (-1.07)	-0 (-0.05)	+0 (+0.34)	-0 (-0.15)	-1 (-1.21)
M6	26	80	+54 (+1.12)	-14 (-0.79)	-1 (-0.12)	+3 (+0.34)	+0 (+0.04)	-28 (-1.21)
E1	52	118	+66 (+0.81)	-15 (-0.33)	+14 (+0.47)	+10 (+0.32)	+3 (+0.09)	-90 (-1.21)
E2C	1,300	1,374	+74 (+0.06)	+1,267 (+0.68)	+1,979 (+1.47)	+703 (+0.32)	+223 (+0.09)	-6,041 (-1.21)
N8	106	193	+87 (+0.60)	-48 (-0.59)	+16 (+0.32)	+17 (+0.33)	-3 (-0.05)	-140 (-1.21)
N1A	10	178	+168 (+2.79)	-4 (-0.52)	+2 (+0.29)	+2 (+0.32)	+0 (+0.05)	-15 (-1.21)
E10	322	514	+192 (+0.47)	-137 (-0.55)	+42 (+0.26)	+50 (+0.31)	+14 (+0.08)	-437 (-1.21)
M3	295	522	+226 (+0.57)	-142 (-0.66)	-4 (-0.03)	+44 (+0.34)	+13 (+0.09)	-362 (-1.21)
E2	405	686	+280 (+0.53)	-180 (-0.59)	+44 (+0.22)	+62 (+0.32)	+16 (+0.07)	-531 (-1.21)
RSF2U2	120	430	+310 (+1.27)	-56 (-0.62)	+14 (+0.24)	+19 (+0.34)	-0 (-0.00)	-154 (-1.21)
E3C	1,856	2,211	+355 (+0.17)	-844 (-0.61)	+187 (+0.20)	+278 (+0.32)	+73 (+0.08)	-2,383 (-1.21)
N4AA	0	370	+370 (+5.91)	-0 (-0.57)	+0 (+0.25)	+0 (+0.32)	+0 (+0.04)	-1 (-1.21)
M2	665	1,038	+372 (+0.44)	-404 (-0.93)	-64 (-0.22)	+75 (+0.34)	+11 (+0.04)	-615 (-1.21)
R4	1,147	1,538	+390 (+0.29)	-856 (-1.37)	-140 (-0.39)	+83 (+0.33)	-49 (-0.15)	-688 (-1.21)
RSF2U1	205	645	+440 (+1.14)	-136 (-1.08)	-10 (-0.14)	+20 (+0.34)	-6 (-0.08)	-164 (-1.21)
E12	342	810	+468 (+0.86)	-225 (-1.07)	-37 (-0.27)	+32 (+0.31)	+10 (+0.09)	-277 (-1.21)
N3A	166	946	+780 (+1.74)	-62 (-0.46)	+31 (+0.35)	+29 (+0.32)	+5 (+0.05)	-248 (-1.21)
A22	6	923	+916 (+4.81)	-4 (-0.91)	-0 (-0.10)	+1 (+0.34)	+0 (+0.02)	-7 (-1.21)
E13	1,356	2,354	+998 (+0.55)	-960 (-1.23)	-197 (-0.40)	+106 (+0.31)	+24 (+0.06)	-932 (-1.21)
E5C	1,021	2,111	+1,090 (+0.73)	-606 (-0.90)	-36 (-0.08)	+114 (+0.32)	+25 (+0.06)	-978 (-1.21)
E4C	705	2,006	+1,300 (+1.04)	-438 (-0.97)	-47 (-0.16)	+73 (+0.32)	+15 (+0.06)	-630 (-1.21)
E14	293	2,298	+2,004 (+2.06)	-121 (-0.53)	+43 (+0.29)	+47 (+0.31)	+12 (+0.07)	-407 (-1.21)
R2	158	6,914	+6,755 (+3.77)	-116 (-1.30)	-13 (-0.27)	+12 (+0.34)	-12 (-0.24)	-102 (-1.21)

Terns

Abundance

Across all complexes, there were 5,673 total sightings of terns (sum sightings during the entire survey period). Compared to the previous year, this was a decrease of 410 total sightings (-6.7%; Fig. 55). There were on average 611 fewer terns detected per survey in fall (Table A2.4), 209 more detected in winter (Table A2.6), and 197 more detected in spring (Table A2.8, Fig. 55).

At the pond level, A14 had the highest abundance (mean count of 135 per survey), followed by E7 (103) and A16 (98; Fig. 56). At these sites, we observed the majority of terns roosting on levees (88.9%), roosting on manmade structures (92.6%), and roosting on islands (64.1%), respectively (Table A4.13). Across all six surveys, the sites with the largest increases in terns from last year were A14 (+70 mean abundance per visit), A11 (+36), and RSF2U1 (+31, while the sites with the largest decreases were A8 (-53), A8S (-52), and A2W (-39; Fig. 57). At E12 (50 birds in winter) and R4 (30 in winter), abundance of terns was higher than ever previously recorded there.

Least Terns have post-breeding foraging targets set within the AMP (67 birds), but these apply to the summer season, when salt pond surveys are no longer conducted. Least Terns are now monitored by SFBBO in a separate program to help inform their conservation and recovery, and we recommended using that report to assess their current status and trends (Schwarz et al. 2024).

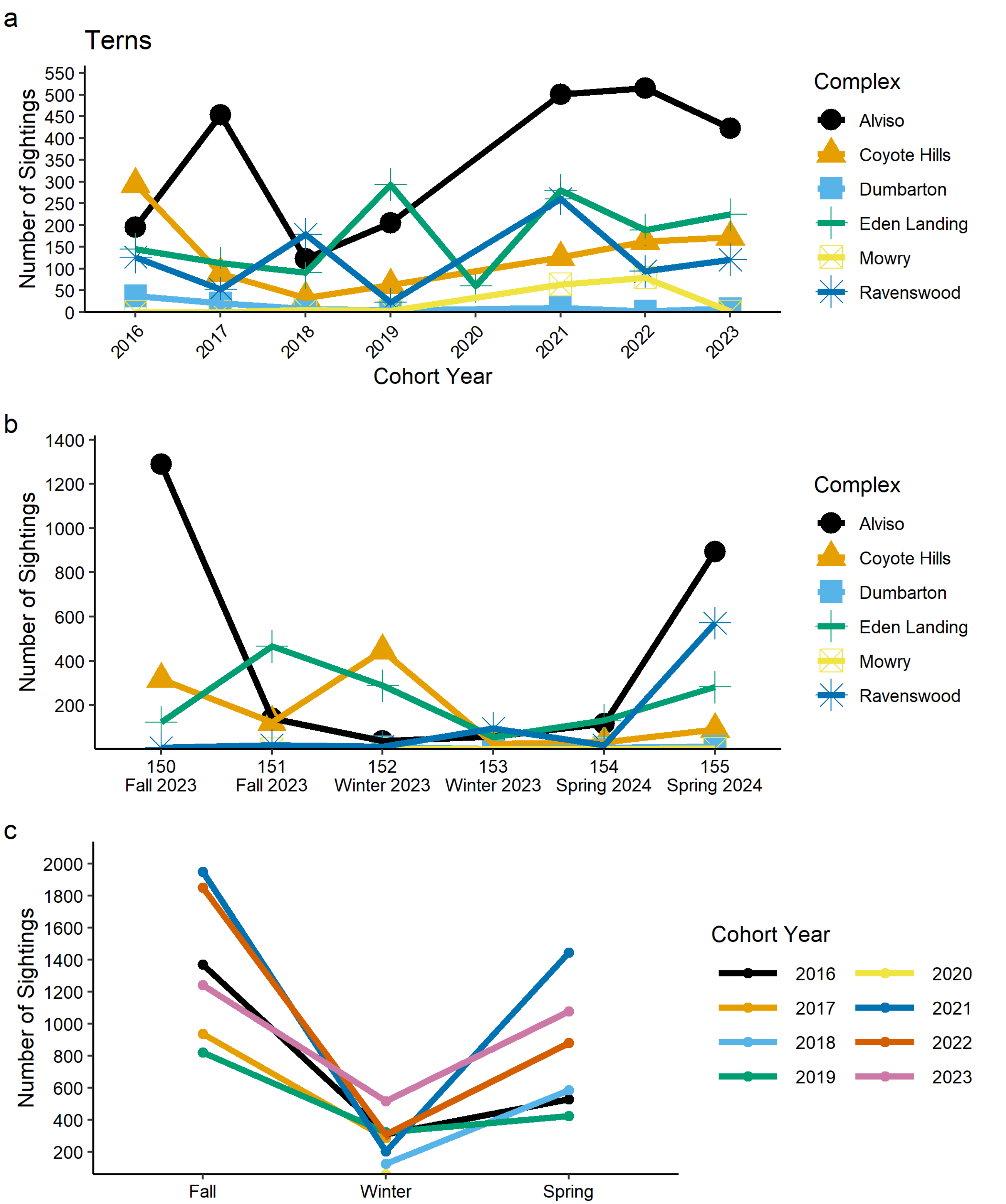

Figure 55. Abundance of terns by (a) study year (September to August of the following year) for each complex (averaged across surveys), (b) survey period for each complex during the current report period (September 2023 – May 2024), and (c) season for each study year at all salt production ponds combined; South San Francisco Bay, California, Sept. 2005 – May 2024 (averaged across surveys). Study years 2019 and 2020 contain incomplete survey rounds.

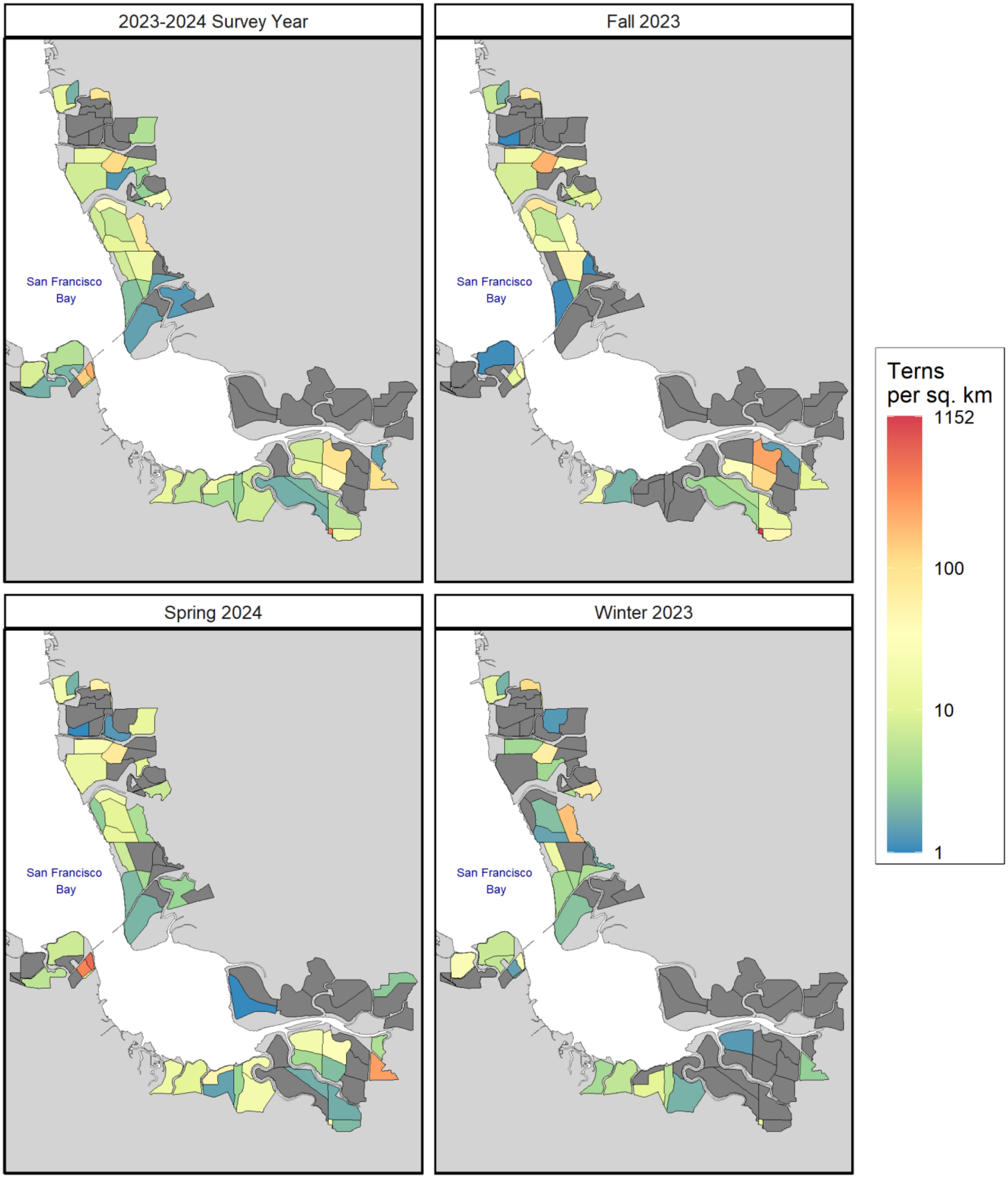

Figure 56. Density of terns averaged across survey rounds by season, South San Francisco Bay, California; September 2023–May 2024. Dark grey ponds had no birds.

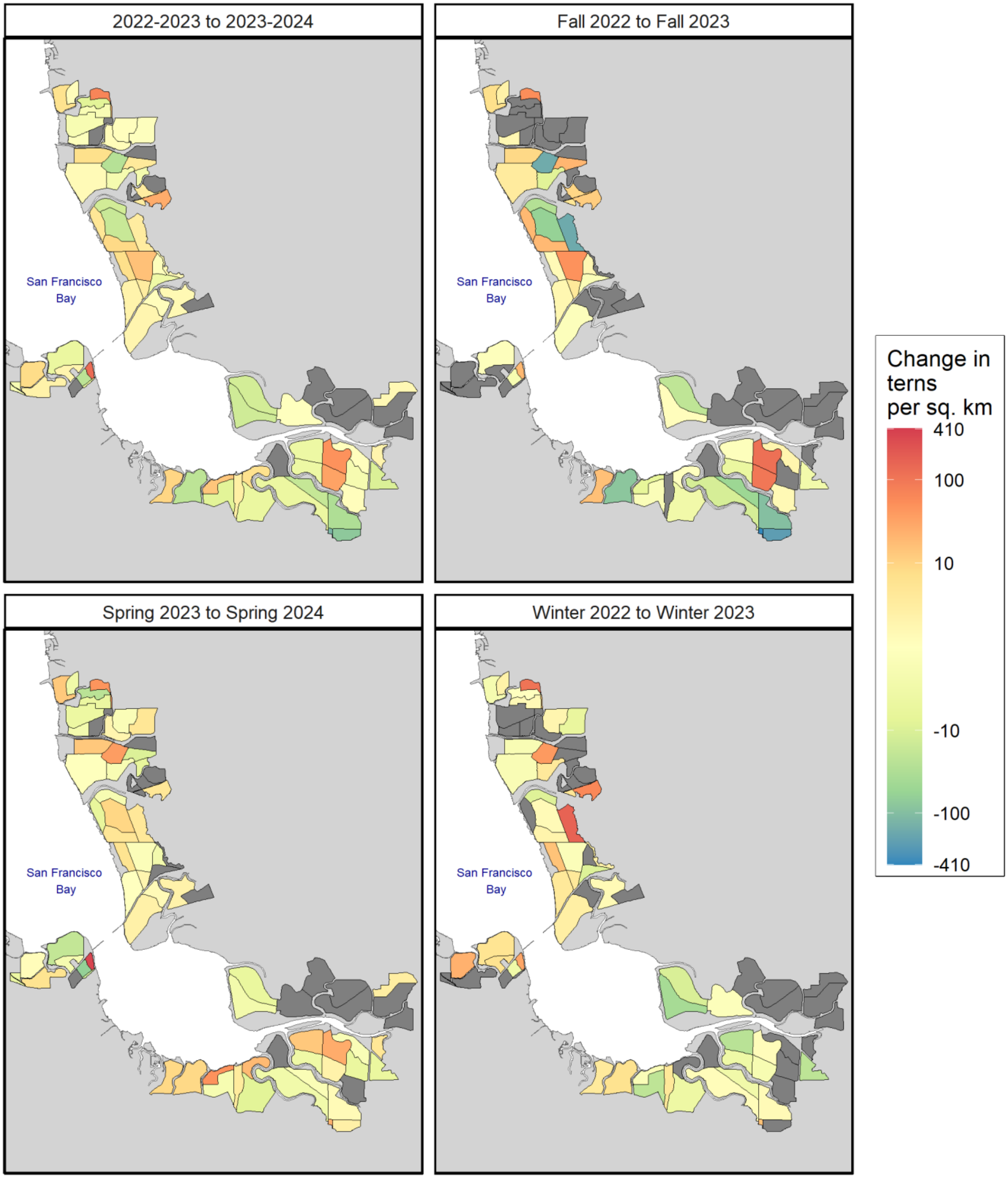

Figure 57. Interannual change in density of terns between September 2022–May 2023 and September 2023–May 2024 in pond habitats of South San Francisco Bay, California. Seasonal panels are density averaged across survey rounds by season, while the Overall panel is averaged across all six survey periods. Dark grey ponds had no birds during that seasonal window in both the current and previous year.

Trends and Trigger Status

No formal targets have been set for terns, but we still provide a comparison to a hypothetical management trigger based on baseline abundance for a more comprehensive assessment of waterbird populations within the South Bay. For terns in fall, this hypothetical trigger—two or more of the past three years of fall abundance below the 2005-2007 baseline value—was not tripped this year because average seasonal abundance was below this threshold in none of the three most recent years of complete surveys (Table 2). The estimated multi-year trend for average fall abundance of terns across the study area was +72 at the end of fall 2024. The trend within the SBSPRP-managed wildlife ponds (+2.35 per km^2, +65 total) was better than the trend within the Cargill-managed salt ponds (-0.43 per km^2, -12 total). The trend within SBSPRP ponds that had been breached to restore tidal marsh was worse than both the wildlife ponds and salt ponds (-0.76 per km^2, -21 total; Fig. 58).

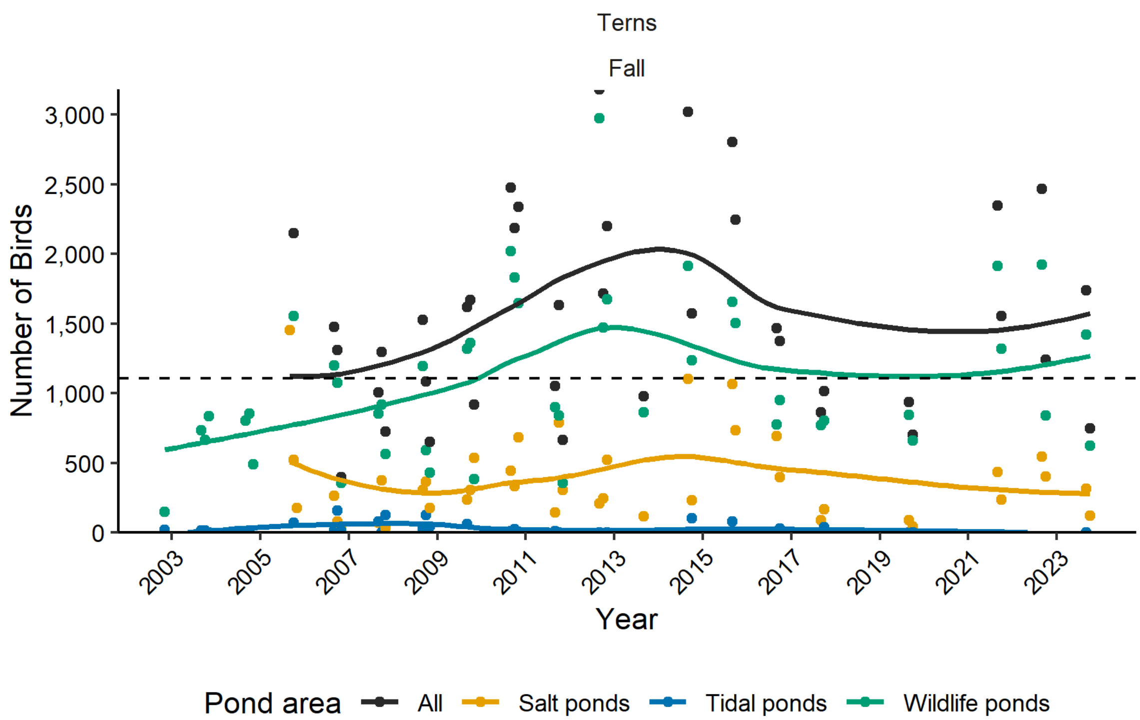

Figure 58. Counts of terns during target season(s) within the South Bay Salt Pond Restoration Project (SBSPRP) and salt production ponds. Lines represent LOESS curves and the dashed lines denote SBSPRP targets or baseline values (average counts from 2005-2007). Ponds A20, A21, A6N, and E10X were excluded from analysis because they were not surveyed after tidal restoration.

Pond Conditions

Alviso

Alviso includes five tidally breached sites (A6S, A17, and A19, as well as A20, A21, and the northern portion of A6, which are no longer surveyed) and a muted tidal pond complex (A5, A7, A8, A8W, A8S). Average salinities in the Alviso complex tended to be highest in the fall and summer survey periods, with the minimum occurring in either the winter or spring survey periods. Average salinity ranged from 1.15 ppt (A8, spring) to 333 ppt (A12, fall; Figs. 59, A7.5). Compared to last year, changes in seasonal salinity ranged from -27.11 ppt at A3N in fall to +166.54 ppt at A22 in fall (Fig. 60). The mean interannual change in salinity across all sites was +11.85 ppt in fall, +14.2 ppt in winter, and +7.05 ppt in spring.

Average dissolved oxygen concentrations ranged from a low of 1.6 mg/L (A10, fall) to a high of 24.4 mg/L (A13, spring; (Figs. 61, A7.5). Changes in seasonal average dissolved oxygen since last year ranged from -6.79 mg/L at A7 in winter to +6.34 mg/L at A13 spring (Fig. 62). The mean interannual change in dissolved oxygen across all sites was -0.55 mg/L in fall, +14.2 mg/L in winter, and +7.05 mg/L in spring.

Average pH values ranged from a low of 5.77 in A23 in winter to a high of 9.48 in A16 in spring, and generally did not display strong seasonal patterns (Figs. 63, A7.9). Changes in seasonal pH from last year ranged from -1.47 at A23 in winter to +0.85 at A9 in spring (Fig. 64). The mean interannual change in pH across all sites was -0.12 in fall, -0.11 in winter, and +0.06 in spring.

Following expected seasonal patterns, water temperature at the surface ranged from 11.47 ˚C (A1 in winter) to 29.87 ˚C (A12 in spring; (Figs. 65, A7.13). Compared to last year average seasonal water temperature changes in ponds ranged from -3.8 ˚C at A2E in fall to +15.01 ˚C at A9 in spring (Fig. 66). The mean interannual change in temperature across all sites was +2.1 ˚C in fall, +2.89 ˚C in winter, and +4.9 ˚C in spring.

Staff gauges are present and functional on all ponds in the Alviso complex except A10, A11, A12, A15, A19, A22, A23, A2E, A6S, A8, A8S, and A8W. Staff gauge levels ranged in the Alviso complex from -1.2 ft at A3W in spring, to 7.9 ft in A17 in fall (Figs. 67, A7.17). For ponds where staff gauge measurements could be obtained in both years, changes in seasonal water depth from last year ranged from -1.3 ft at A17 in spring to +1.5 ft at A3W in spring (Fig. 68). The mean interannual change in water level across all sites was +0.31 ft in fall, +0 ft in winter, and +0 ft in spring.

Some water quality information was unavailable for certain surveys at ponds A23, A23, A23, and A6S because they were surveyed on days when they were dry or when water quality equipment was malfunctioning.

Coyote Hills

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 salinity ranged from 13.48 ppt (N8, winter) to 130.95 ppt (N4AA, fall; Figs. 59, A7.6). Compared to last year, changes in seasonal salinity ranged from -13.9 ppt at N6 in fall to +43.49 ppt at N4AA in fall (Fig. 60). The mean interannual change in salinity across all sites was -3.23 ppt in fall, +5.08 ppt in winter, and +4.69 ppt in spring.

Average dissolved oxygen concentrations ranged from a low of 1.69 mg/L (N3A, fall) to a high of 17.76 mg/L (N4AA, winter; (Figs. 61, A7.6). Changes in seasonal average dissolved oxygen since last year ranged from -6.3 mg/L at N4AA in spring to +5.62 mg/L at N8 fall (Fig. 62). The mean interannual change in dissolved oxygen across all sites was +1.31 mg/L in fall, +5.08 mg/L in winter, and +4.69 mg/L in spring.

Average pH values ranged from a low of 5.52 in N8 in winter to a high of 9.25 in N8 in fall, and generally did not display strong seasonal patterns (Figs. 63, A7.10). Changes in seasonal pH from last year ranged from -1.62 at N5 in fall to +0.84 at N4AB in winter (Fig. 64). The mean interannual change in pH across all sites was -0.36 in fall, -0.02 in winter, and +0.17 in spring.

Following expected seasonal patterns, water temperature at the surface ranged from 9.12 ˚C (N9 in winter) to 28.17 ˚C (N6 in fall; (Figs. 65, A7.14). Compared to last year average seasonal water temperature changes in ponds ranged from -2.68 ˚C at N4B in spring to +10.72 ˚C at N6 in fall (Fig. 66). The mean interannual change in temperature across all sites was +3.19 ˚C in fall, +2.45 ˚C in winter, and +0.32 ˚C in spring.

Staff gauges are present and functional on all ponds in the Coyote Hills complex except N4AB and N4B. Staff gauge levels ranged in the Coyote Hills complex from 0.5 ft at N9 in winter, to 4.6 ft in N6 in winter (Figs. 67, A7.18). For ponds where staff gauge measurements could be obtained in both years, changes in seasonal water depth from last year ranged from -5.6 ft at N5 in spring to +0.95 ft at N6 in winter (Fig. 68). The mean interannual change in water level across all sites was -0.3 ft in fall, -0.67 ft in winter, and -1.04 ft in spring.

Some water quality information was unavailable for certain surveys at pond N6 because it was surveyed on days when it was dry or when water quality equipment was malfunctioning.

Dumbarton

The Dumbarton complex was characterized by moderate salinities, and salinity tended to increase as water moved east within the system. Average salinity ranged from 49.79 ppt (N3, winter) to 131.75 ppt (NPP1, fall; Figs. 59, A7.6). Compared to last year, changes in seasonal salinity ranged from -15.92 ppt at N2 in fall to +45.04 ppt at NPP1 in winter (Fig. 60). The mean interannual change in salinity across all sites was -6.49 ppt in fall, +25.9 ppt in winter, and +20.89 ppt in spring.

Average dissolved oxygen concentrations ranged from a low of 2.7 mg/L (NPP1, spring) to a high of 20.08 mg/L (NPP1, fall; (Figs. 61, A7.6). Changes in seasonal average dissolved oxygen since last year ranged from -1.95 mg/L at NPP1 in winter to +9.38 mg/L at NPP1 fall (Fig. 62). The mean interannual change in dissolved oxygen across all sites was +3.64 mg/L in fall, +25.9 mg/L in winter, and +20.89 mg/L in spring.

Average pH values ranged from a low of 7.54 in NPP1 in winter to a high of 8.5 in N2 in spring, and generally did not display strong seasonal patterns (Figs. 63, A7.10). Changes in seasonal pH from last year ranged from -0.23 at N2 in winter to +0.44 at N2 in spring (Fig. 64). The mean interannual change in pH across all sites was +0.07 in fall, -0.13 in winter, and +0.36 in spring.

Following expected seasonal patterns, water temperature at the surface ranged from 11.63 ˚C (N2 in winter) to 26.66 ˚C (NPP1 in fall; (Figs. 65, A7.14). Compared to last year average seasonal water temperature changes in ponds ranged from -0.57 ˚C at N3 in fall to +9.13 ˚C at N2 in spring (Fig. 66). The mean interannual change in temperature across all sites was +3.88 ˚C in fall, +1.74 ˚C in winter, and +4.74 ˚C in spring.

Staff gauges are present and functional on all ponds in the Dumbarton complex except NPP1. Staff gauge levels ranged in the Dumbarton complex from 1.3 ft at N1 in fall, to 3.9 ft in N3 in spring (Figs. 67, A7.18). For ponds where staff gauge measurements could be obtained in both years, changes in seasonal water depth from last year ranged from -0.8 ft at N1 in winter to +0.17 ft at N3 in fall (Fig. 68). The mean interannual change in water level across all sites was +0.12 ft in fall, -0.5 ft in winter, and -0.4 ft in spring.

Eden Landing

The Eden Landing complex had five tidally breached sites (E8AE, E8AW, E8XN, E8XS, and E9) and was otherwise characterized by mostly low to moderate salinities, with one high salinity pond (E6C). Average salinity ranged from 8.99 ppt (E6A, spring) to 162 ppt (E6C, fall; Figs. 59, A7.8). Compared to last year, changes in seasonal salinity ranged from -85.5 ppt at E6C in fall to +70.97 ppt at E6C in spring (Fig. 60). The mean interannual change in salinity across all sites was -17.71 ppt in fall, +2.13 ppt in winter, and +12.65 ppt in spring.

Average dissolved oxygen concentrations ranged from a low of 0.32 mg/L (E13, fall) to a high of 23.12 mg/L (E6A, fall; (Figs. 61, A7.8). Changes in seasonal average dissolved oxygen since last year ranged from -13.2 mg/L at E7 in winter to +6.71 mg/L at E6A fall (Fig. 62). The mean interannual change in dissolved oxygen across all sites was +0.5 mg/L in fall, +2.13 mg/L in winter, and +12.65 mg/L in spring.

Average pH values ranged from a low of 5.03 in E1 in fall to a high of 9.26 in E5 in spring, and generally did not display strong seasonal patterns (Figs. 63, A7.12). Changes in seasonal pH from last year ranged from -1.42 at E1 in fall to +0.84 at E9 in winter (Fig. 64). The mean interannual change in pH across all sites was -0.08 in fall, -0.05 in winter, and +0.3 in spring.

Following expected seasonal patterns, water temperature at the surface ranged from 10.71 ˚C (E9 in winter) to 30.88 °C (E2 in fall; (Figs. 65, A7.16). Compared to last year average seasonal water temperature changes in ponds ranged from -6.06 ˚C at E6C in fall to +13.4 ˚C at E4C in spring (Fig. 66). The mean interannual change in temperature across all sites was +2.82 ˚C in fall, +2.06 ˚C in winter, and +4.43 ˚C in spring.

Staff gauges are present and functional on all ponds in the Eden Landing complex except E4C, E6, E7, E8AE, and E8AW. Staff gauge levels ranged in the Eden Landing complex from 0.6 ft at E11 in fall, to 9 ft in E12 in winter (Figs. 67, A7.20). For ponds where staff gauge measurements could be obtained in both years, changes in seasonal water depth from last year ranged from -2.45 ft at E2C in spring to +2.9 ft at E4 in spring (Fig. 68). The mean interannual change in water level across all sites was -0.02 ft in fall, +0.21 ft in winter, and -0.3 ft in spring.

Some water quality information was unavailable for certain surveys at ponds E11, E4C, and E6C because they were surveyed on days when they were dry or when water quality equipment was malfunctioning.

Mowry

The Mowry complex was characterized by moderate to high salinity ponds. Salinity increased as water moved east within the system, with ponds M1, M2, and M3 generally having lower salinity than ponds M4, M5, and M6. Average salinity ranged from 62.54 ppt (M1, winter) to 294.67 ppt (M6, fall; Figs. 59, A7.6). Compared to last year, changes in seasonal salinity ranged from -18.51 ppt at M2 in spring to +99.33 ppt at M4 in fall (Fig. 60). The mean interannual change in salinity across all sites was +69.93 ppt in fall, +36.35 ppt in winter, and +13 ppt in spring.

Average dissolved oxygen concentrations ranged from a low of 1.97 mg/L (M3, spring) to a high of 11.94 mg/L (M3, winter; (Figs. 61, A7.6). Changes in seasonal average dissolved oxygen since last year ranged from -3.65 mg/L at M6 in spring to +1.84 mg/L at M3 winter (Fig. 62). The mean interannual change in dissolved oxygen across all sites was -0.95 mg/L in fall, +36.35 mg/L in winter, and +13 mg/L in spring.

Average pH values ranged from a low of 7.09 in M6 in fall to a high of 8.56 in M2 in winter, and generally did not display strong seasonal patterns (Figs. 63, A7.10). Changes in seasonal pH from last year ranged from -0.43 at M5 in winter to +0.31 at M3 in winter (Fig. 64). The mean interannual change in pH across all sites was -0.23 in fall, -0.05 in winter, and +0.14 in spring.

Following expected seasonal patterns, water temperature at the surface ranged from 7.53 ˚C (M6 in winter) to 27.05 ˚C (M4 in fall; (Figs. 65, A7.14). Compared to last year average seasonal water temperature changes in ponds ranged from -5.13 ˚C at M6 in fall to +5.35 ˚C at M1 in winter (Fig. 66). The mean interannual change in temperature across all sites was -0.81 ˚C in fall, +3.23 ˚C in winter, and +1.83 ˚C in spring.

Staff gauges are present and functional on all ponds in the Mowry complex except M4 and M6. Staff gauge levels ranged in the Mowry complex from 0 ft at M1 in fall, to 5 ft in M5 in spring (Figs. 67, A7.18). For ponds where staff gauge measurements could be obtained in both years, changes in seasonal water depth from last year ranged from -2 ft at M1 in winter to +0.45 ft at M2 in spring (Fig. 68). The mean interannual change in water level across all sites was -1.07 ft in fall, -0.83 ft in winter, and -0.2 ft in spring.

Some water quality information was unavailable for certain surveys at ponds M4 and M5 because they were surveyed on days when they were dry or when water quality equipment was malfunctioning.

Ravenswood

The Ravenswood complex was characterized by six high salinity ponds, three low salinity ponds (RSF2U1, U2 and U4), and one tidally breached site (R4). 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. Average salinity ranged from 15.75 ppt (RSF2U4, spring) to 313.33 ppt (R2, fall; Figs. 59, A7.7). Compared to last year, changes in seasonal salinity ranged from -90.83 ppt at R3 in spring to +120.76 ppt at R4 in fall (Fig. 60). The mean interannual change in salinity across all sites was +19.01 ppt in fall, +28.07 ppt in winter, and -2.01 ppt in spring.

Average dissolved oxygen concentrations ranged from a low of 0.96 mg/L (R3, fall) to a high of 22.16 mg/L (RSF2U1, fall; (Figs. 61, A7.7). Changes in seasonal average dissolved oxygen since last year ranged from -9.97 mg/L at RSF2U1 in spring to +2.71 mg/L at RSF2U1 fall (Fig. 62). The mean interannual change in dissolved oxygen across all sites was -1.51 mg/L in fall, +28.07 mg/L in winter, and -2.01 mg/L in spring.

Average pH values ranged from a low of 4.48 in R3 in fall to a high of 8.85 in RSF2U2 in spring, and generally did not display strong seasonal patterns (Figs. 63, A7.11). Changes in seasonal pH from last year ranged from -2.23 at R3 in fall to +1.12 at R3 in spring (Fig. 64). The mean interannual change in pH across all sites was -1 in fall, -0.27 in winter, and -0.04 in spring.

Following expected seasonal patterns, water temperature at the surface ranged from 8.81 ˚C (R5S in winter) to 31.13 ˚C (R5 in fall; (Figs. 65, A7.15). Compared to last year average seasonal water temperature changes in ponds ranged from -5.16 ˚C at R2 in fall to +13.71 ˚C at R3 in fall (Fig. 66). The mean interannual change in temperature across all sites was +3.44 ˚C in fall, +0.95 ˚C in winter, and +1.25 ˚C in spring.

Staff gauges are present and functional on all ponds in the Ravenswood complex except R3, R4, R5, and R5S. Staff gauge levels ranged in the Ravenswood complex from 0 ft at R2 in fall, to 6.2 ft in RSF2U4 in fall (Figs. 67, A7.19). For ponds where staff gauge measurements could be obtained in both years, changes in seasonal water depth from last year ranged from -0.95 ft at RSF2U1 in winter to +1.75 ft at RSF2U4 in fall (Fig. 68). The mean interannual change in water level across all sites was +0.4 ft in fall, -0.16 ft in winter, and -0.11 ft in spring.

Some water quality information was unavailable for certain surveys at ponds R3, R5, R5, R5S, and R5S because they were surveyed on days when they were dry or when water quality equipment malfunctioned.

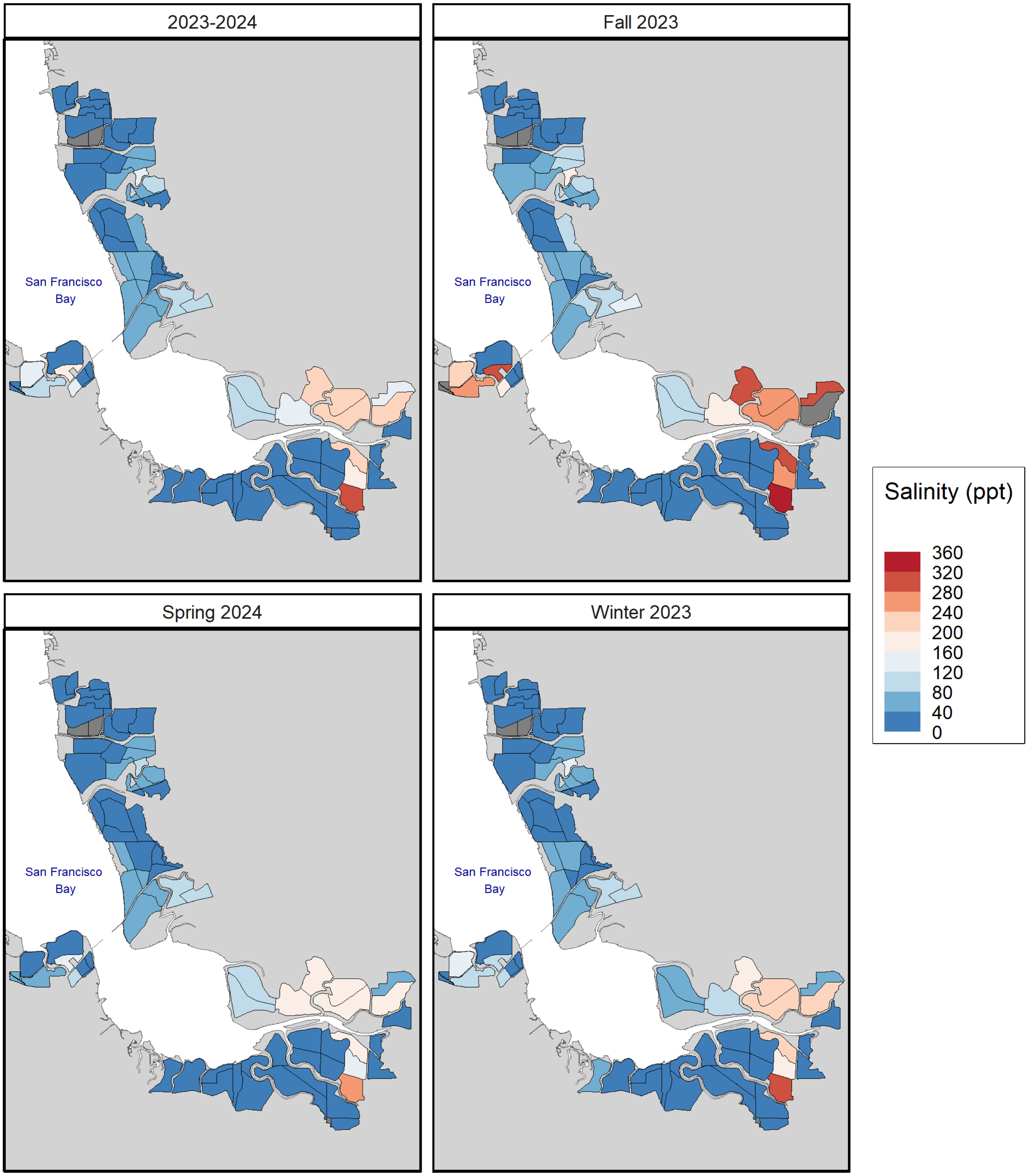

Figure 59. Salinity (ppt) between September 2023–May 2024, averaged across survey rounds by season, in pond habitats of South San Francisco Bay, California. Dark grey ponds were not measured for this pond characteristic during that survey period.

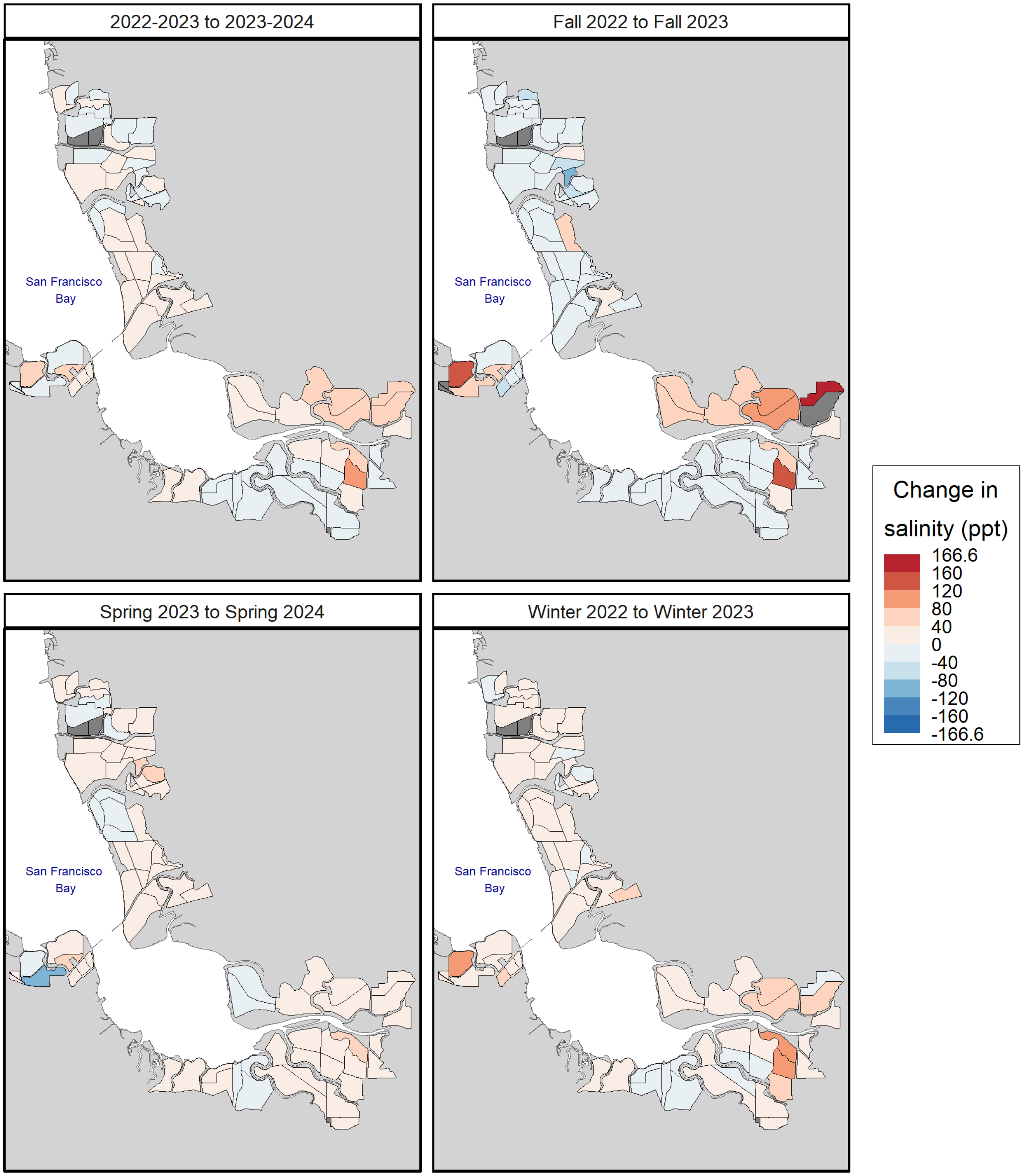

Figure 60. Change in salinity (ppt) between September 2022–May 2023 and September 2023–May 2024, averaged across survey rounds by season, in pond habitats of South San Francisco Bay, California. Dark grey ponds were not measured for this pond characteristic in one or both periods.

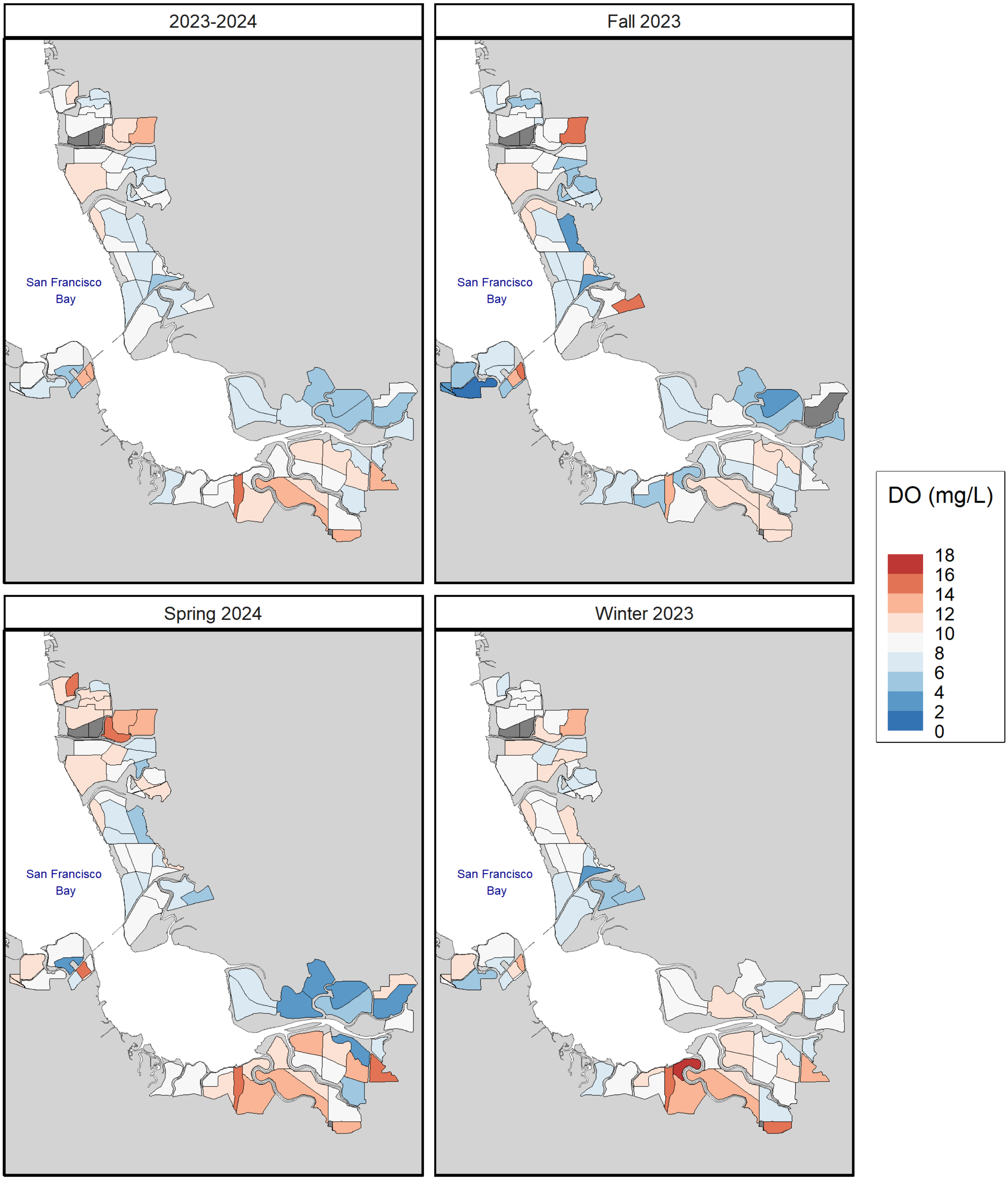

Figure 61. Dissolved oxygen (mg/L) between September 2023–May 2024, averaged across survey rounds by season, in pond habitats of South San Francisco Bay, California. Dark grey ponds were not measured for this pond characteristic during that survey period.

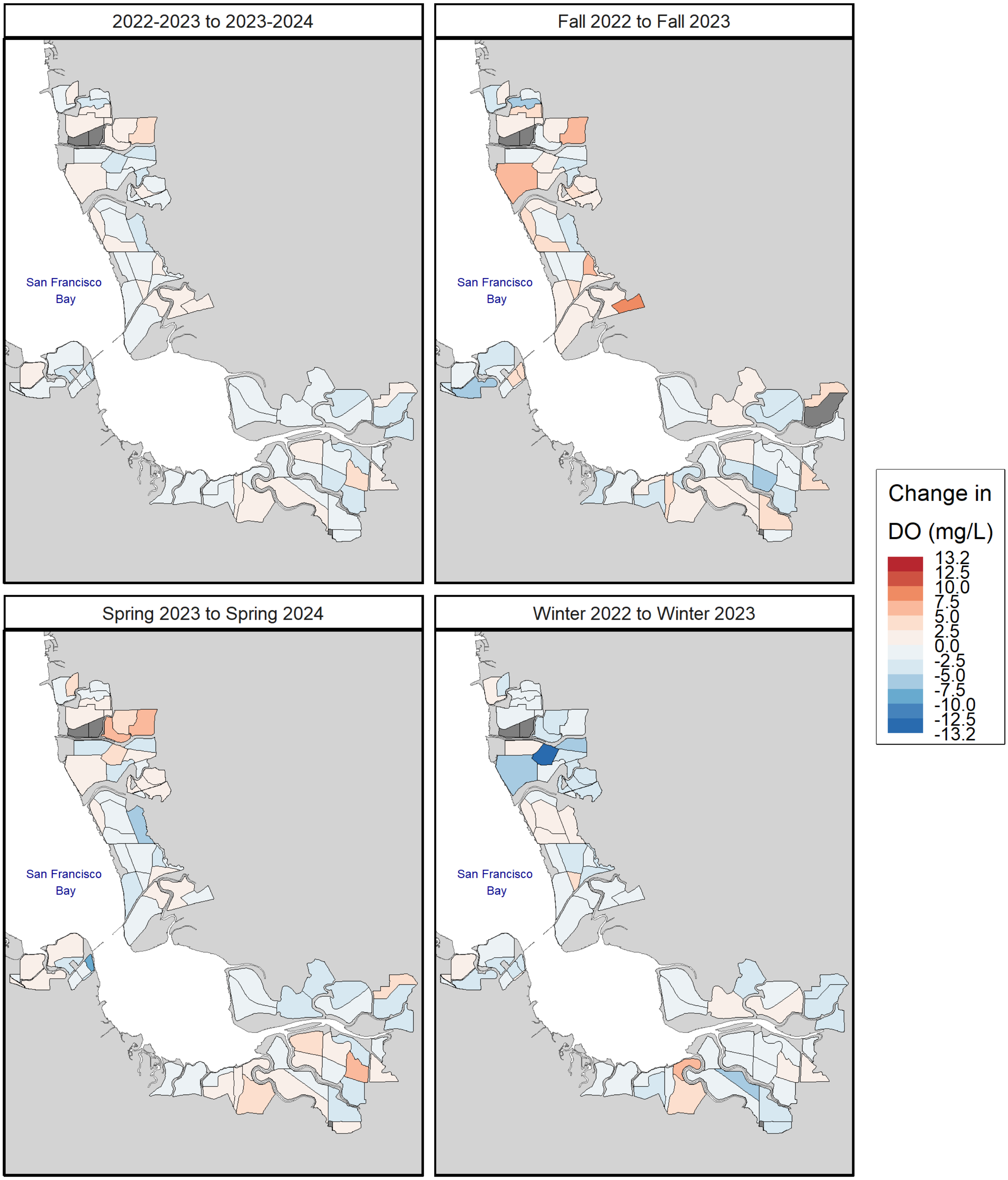

Figure 62. Change in dissolved oxygen (mg/L) between September 2022–May 2023 and September 2023–May 2024, averaged across survey rounds by season, in pond habitats of South San Francisco Bay, California. Dark grey ponds were not measured for this pond characteristic in one or both periods.

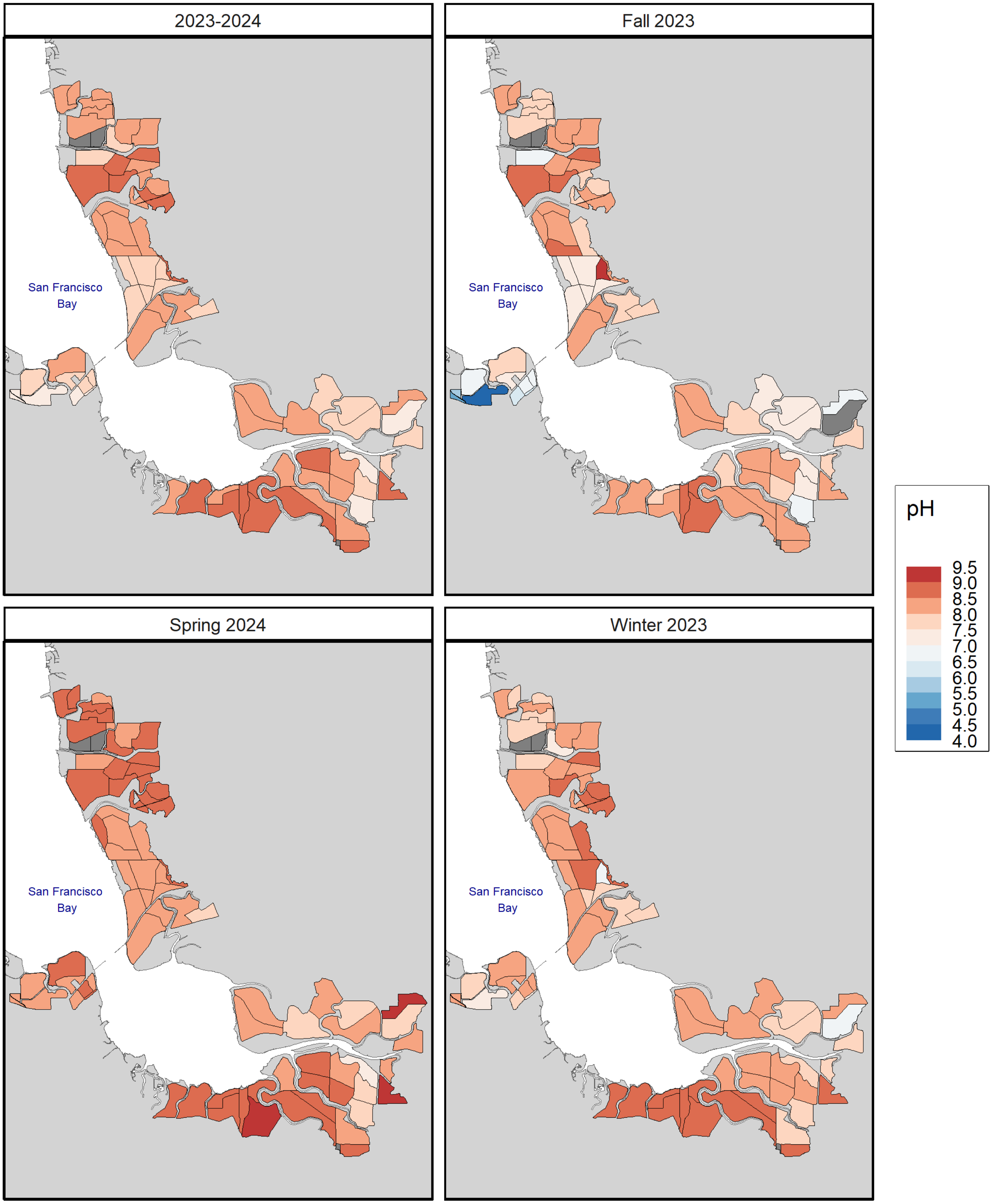

Figure 63. pH between September 2023–May 2024, averaged across survey rounds by season, in pond habitats of South San Francisco Bay, California. Dark grey ponds were not measured for this pond characteristic during that survey period.

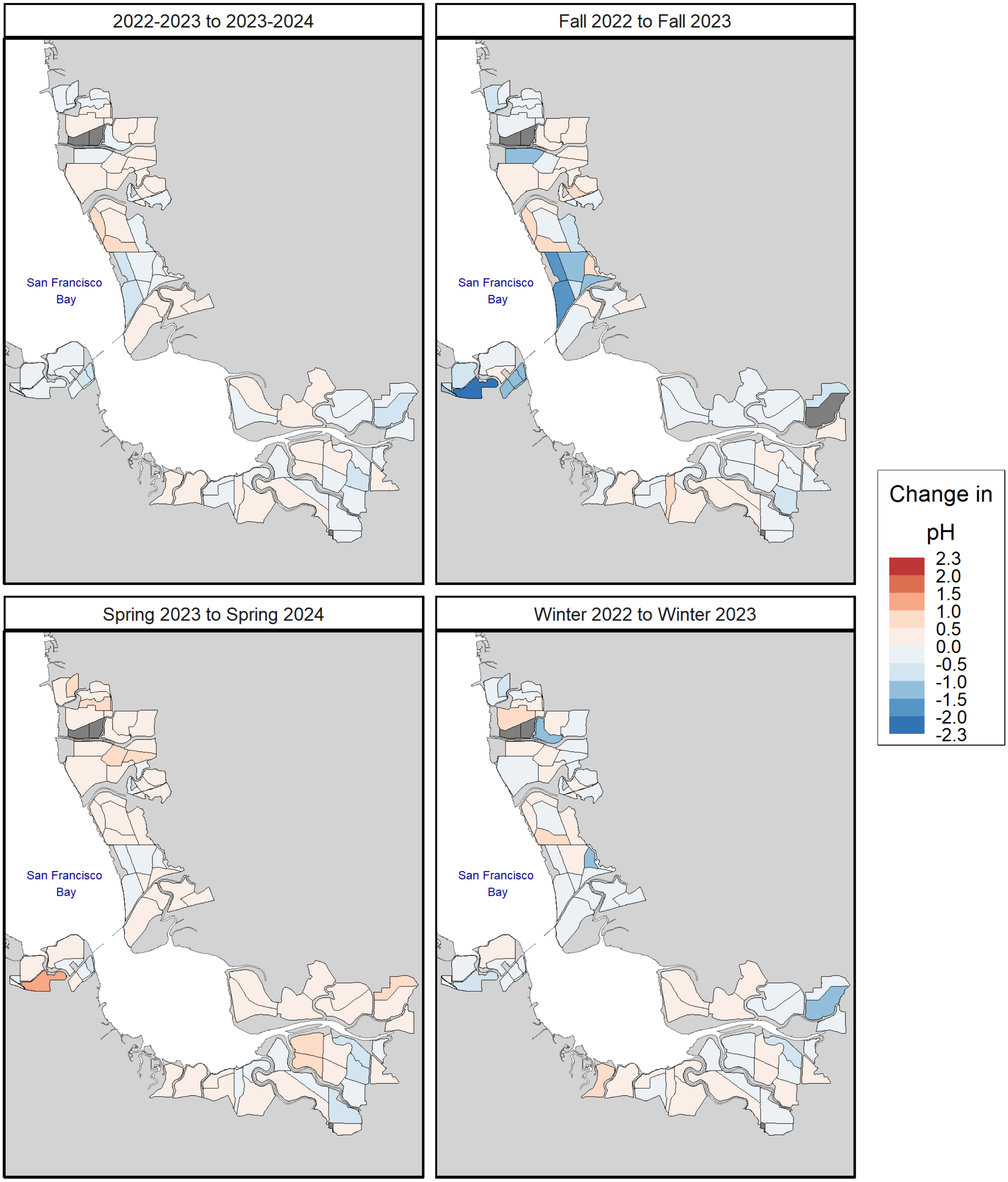

Figure 64. Change in pH between September 2022–May 2023 and September 2023–May 2024, averaged across survey rounds by season, in pond habitats of South San Francisco Bay, California. Dark grey ponds were not measured for this pond characteristic in one or both periods.

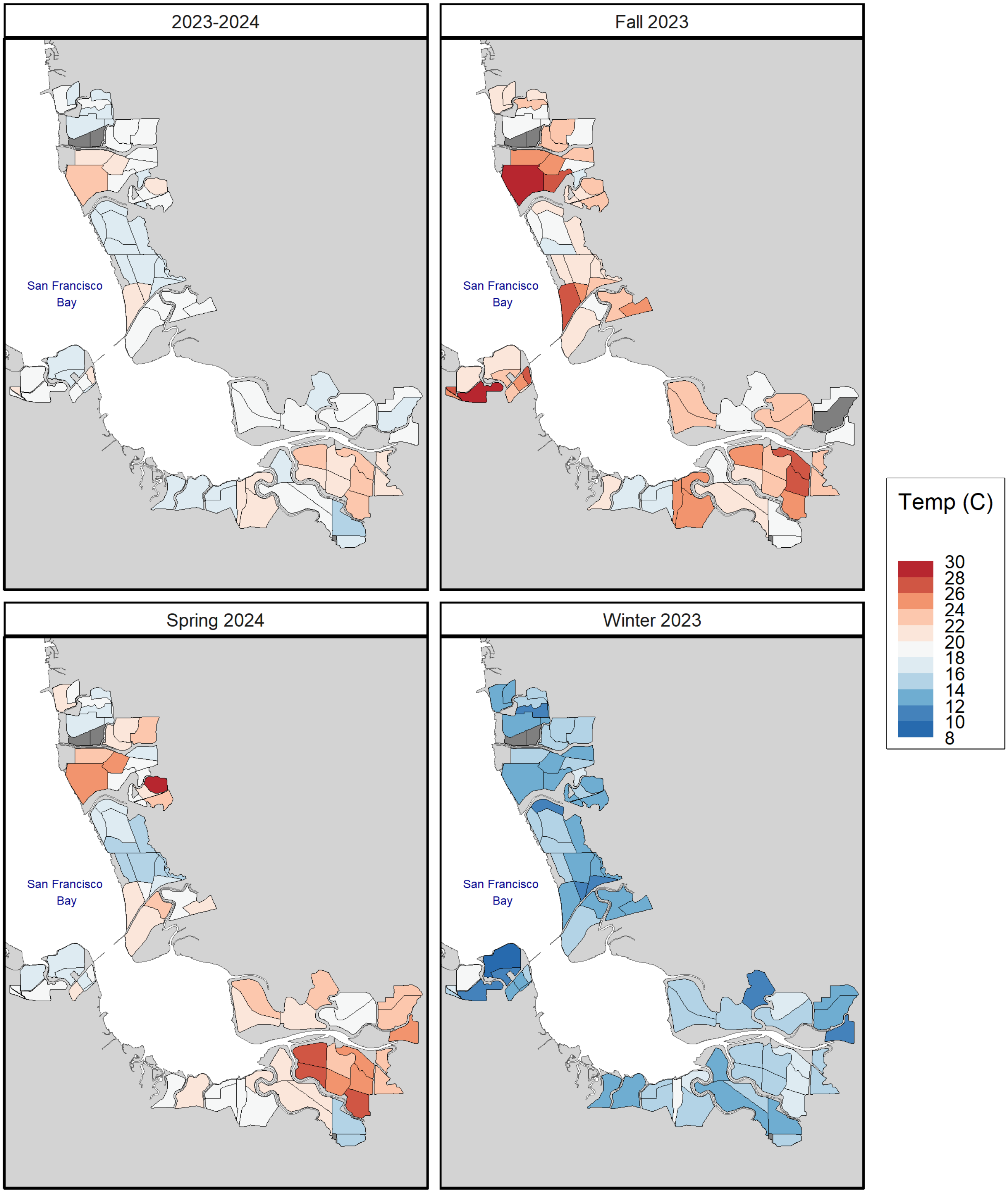

Figure 65. Temperature (C) between September 2023–May 2024, averaged across survey rounds by season, in pond habitats of South San Francisco Bay, California. Dark grey ponds were not measured for this pond characteristic during that survey period.

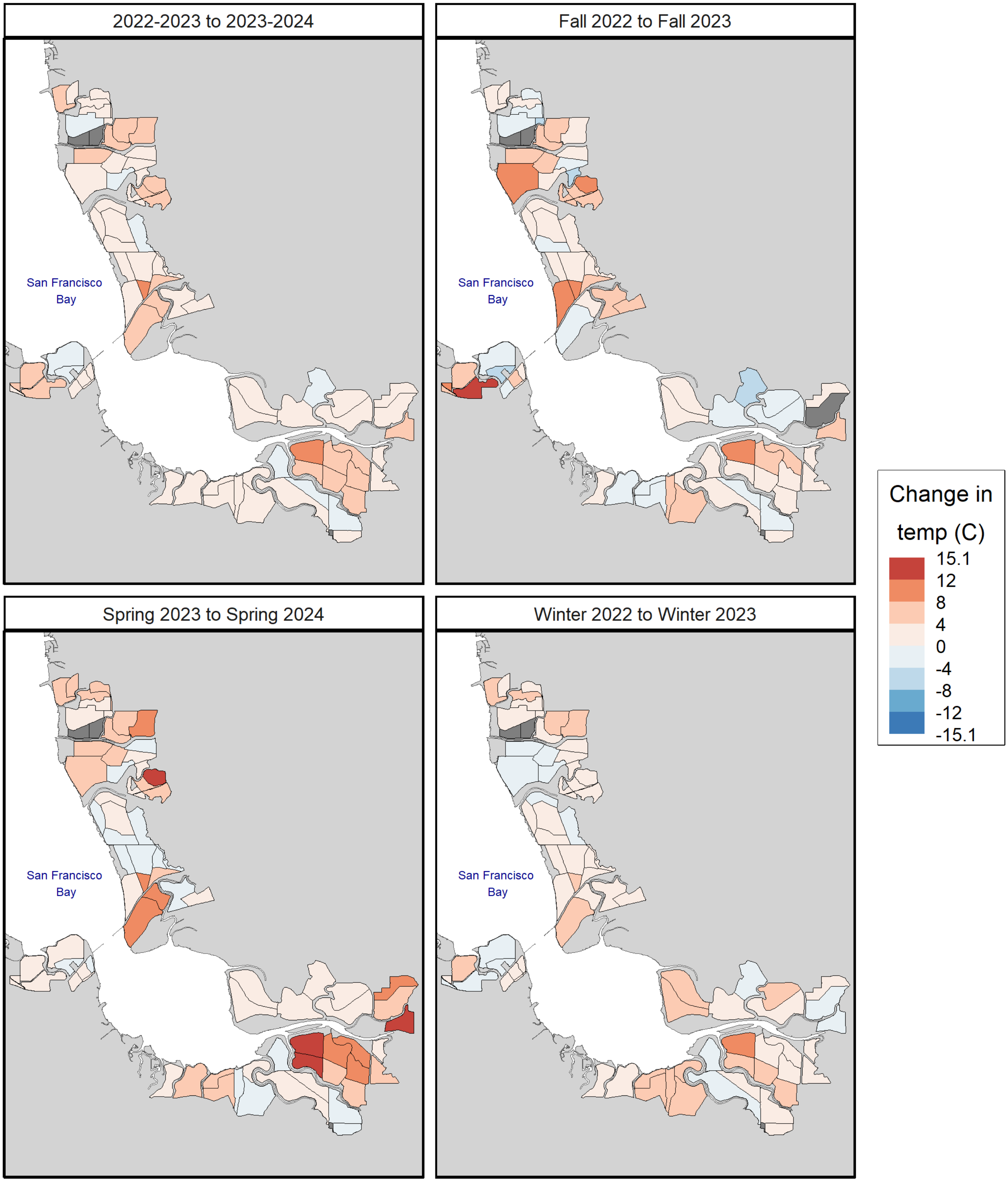

Figure 66. Change in temperature (C) between September 2022–May 2023 and September 2023–May 2024, averaged across survey rounds by season, in pond habitats of South San Francisco Bay, California. Dark grey ponds were not measured for this pond characteristic in one or both periods.

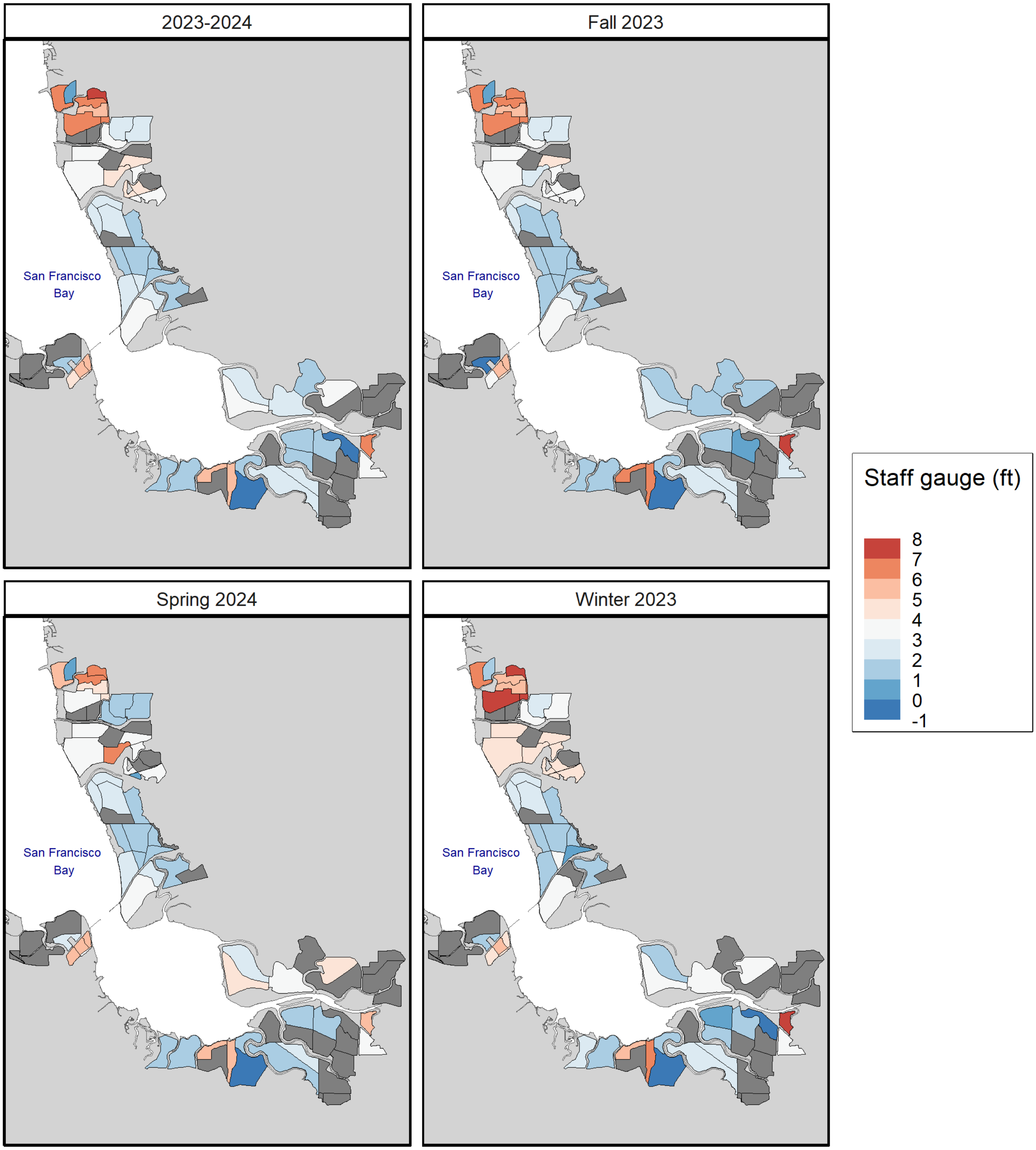

Figure 67. Staff gauge reading (ft) between September 2023–May 2024, averaged across survey rounds by season, in pond habitats of South San Francisco Bay, California. Dark grey ponds were not measured for this pond characteristic during that survey period.

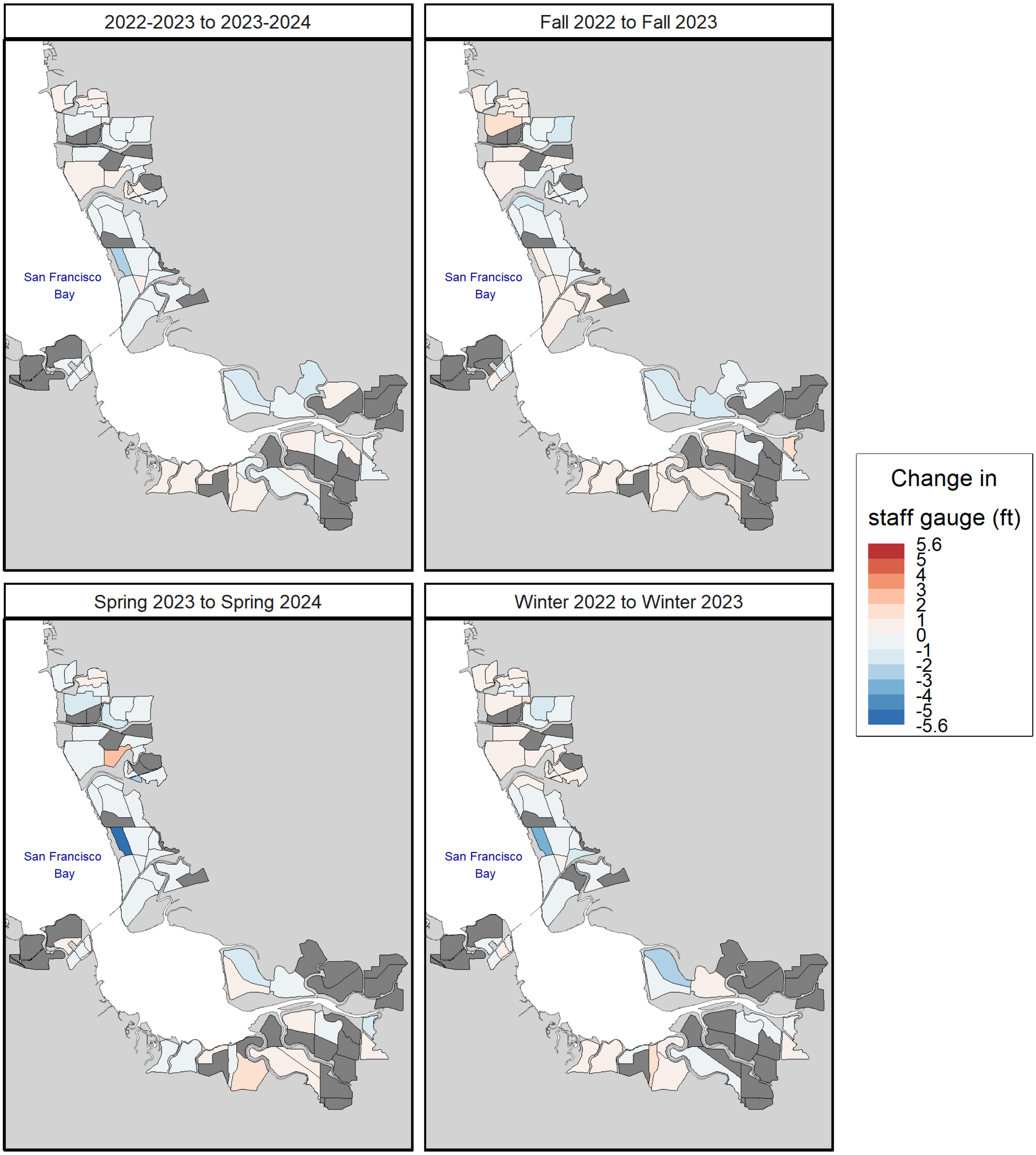

Figure 68. Change in staff gauge reading (ft) between September 2022–May 2023 and September 2023–May 2024, averaged across survey rounds by season, in pond habitats of South San Francisco Bay, California. Dark grey ponds were not measured for this pond characteristic in one or both periods.

Discussion

Management Triggers

Restoration efforts have been underway for over twenty years, and analyses of long-term population trends have shown some species and guilds are declining within South San Francisco Bay. Of the 9 targets set by the AMP or USFWS, **5** were below their multi-year trigger thresholds based on abundances in the past three years: dabbling ducks, Bonaparte's Gulls, phalaropes, small shorebirds in spring, and medium shorebirds (Table 2). Of the larger set of 13 taxa we assessed (counting small shorebirds in both fall and spring), 6 taxa (46%) had their average abundances across those three years higher than their 2005–2007 SBSPRP baseline values, with a slight majority having underwent declines.

While this indicates many guilds have experienced long-term benefits of the restoration and enhancement activities for waterbird populations within South San Francisco Bay, other guilds show signs of decline. Management triggers are currently passed for 8 species/guilds: Bonaparte's Gulls, dabbling ducks, fisheaters, gulls, herons and egrets, medium shorebirds, phalaropes, and small shorebirds. Two species/guilds that specialize in saline habitats have declined below trigger values: phalaropes and Bonaparte's Gulls (Table 2; Burns et al. 2023, Van Schmidt 2023). Despite increasing within the South Bay overall, Eared Grebe counts are approaching zero within the SBSPRP footprint, with increases largely due to population growth in the salt production ponds. Studies have also found that breeding waterbirds have declined within South San Francisco Bay (Hartman et al. 2021). Even for species that have increased, several have declined again in recent years, passing trigger thresholds. This may simply be cyclical population dynamics resulting from annual weather or density-dependent regulation (Coates et al. 2021), but results from the change model suggest management changes to ponds may be contributing to some of these declines.

Drivers of Observed Changes

For a decline to be significant under NEPA/CEQA requirements, it must be due to restoration and management activities, which has yet to be determined. At a landscape scale, habitat changes driven by SBSPRP management have been linked to changes in breeding waterbird abundance for four species at a landscape scale: American Avocets (*Recurvirostra americana*), Black-necked Stilts (*Himantopus mexicanus*), Forster's Terns (*Sterna forsteri*), and Caspian Terns (*Hydroprogne caspia*; Schacter et al. 2023). This study found increases in habitat use in managed ponds compared to salt ponds, but not for tidally restored wetlands. De La Cruz et al. (2018) also assessed the relationship between pond characteristics and waterbird trends within the SBSPRP for migratory and wintering species/guilds. Their study had two goals, (1) assessing trends in waterbird populations and (2) identifying habitat characteristics at the pond-scale and within ponds ("grid-scale") that predicted waterbird abundance. Scullen et al. (2013) similarly modeled how water quality parameters related to shorebird abundance, but only within the Cargill-managed ponds. Both of these studies identified covariates of abundance for species that could inform management actions intended to reverse the declines here, and have been highlighted above in the *Results* section for each guild.

While our report provides estimates of the relative degree to which habitat changes versus weather could have driven these declines, importantly, the current study cannot definitively answer this question. R^2 values were generally low (<0.2), indicating that most of the variation in abundance remains unexplained. Ecological models of wide-ranging species like birds often have low R^2, but can achieve higher rates with proper model specification (c.f., Dettmers et al. 1999, Brand et al. 2006). It is unsurprising that our study showed low R^2 because there are significant challenges to modeling population trends of waterbirds in particular and over the long time periods of this study, including potential time lags, cross-scale interactions, incomplete habitat quality and/or abundance data for tidally restored wetlands, and potentially confounding relationships between drivers of waterbird abundance vs. change-in-abundance.

Our guild abundance measures also summarize over multiple species, which may each exhibit varying responses to environmental conditions.

A conclusive determination of whether SBSPRP management actions have caused the observed declines therefore requires continuing to develop the model until a sufficient proportion of the variance in change in counts is attributable to either weather or site conditions. Setting a target R^2 is difficult because very stochastic processes may naturally have low R^2, with some sources of variability potentially impossible to address within the model. Because waterbirds are exceptionally wide-ranging, it is very likely some variability in counts is explainable only by conditions on breeding or wintering grounds. Even if pond conditions remain the same there may be natural spatial and temporal variation in when and which ponds they utilize on any given day of surveys. Based on these considerations, we recommend a general rule of thumb would be to continue model development at a minimum until R^2c (i.e., both fixed effects of covariates and year random effect) exceeds 0.50 in guilds that have crossed their AMP of USFWS trigger threshold, and R^2m (fixed effects of covariates only) exceeds 0.33. The highest priority for model development should be the guilds that have crossed their AMP or USFWS trigger thresholds. Initial steps should be attempting to fit quadratic or non-linear forms, interactions terms, and alternative specifications of change. More advanced options include developing species-specific models or an explicit time-series model (i.e., a population model).

For the time being, we recommend the current report should be interpreted as preliminary findings on the potential scale and relative importance of habitat and climatic effects. While not a conclusive documentation of drivers of waterbird declines, those significant results we have found and their resulting site-level predictions can be used as an warning system to identify habitat changes that may detrimental to each waterbird guild.

Habitat Changes

One of the biggest changes in management within the SBSPRP has been the reduction of hypersaline ponds as part of the Initial Stewardship Plan. As early as summer 2004, actions were taken to reduce salinity in hypersaline ponds to transition them away from salt production, and most ponds had transitioned by fall 2005 (SBSPRP 2007). Ponds A12–A15, E5, and E6 were retained as high salinity ponds. Our results clearly demonstrate that reductions in salinities directly corresponded to statistically significant increases in abundances of most assessed guilds. Of the eight target species/guilds assessed, six showed a statistically significantly increase in abundance in relation to decreases in salinities (or vice versa). Surprisingly, this included phalaropes, a specialist in saline habitats. Only Bonaparte’s Gull showed a relationship between decreasing abundance and decreasing salinity. Eared Grebes, another species frequently associated with salt ponds, did not show support for a relationship with salinity, echoing the findings of De La Cruz et al. (2018). The increase in abundance after the ponds were transition from salt production for most of these species is a major success of the project. However, the finding for Bonaparte’s Gulls supports the hypothesis that SBSPRP management actions have contributed to the decline of this species within South San Francisco Bay.

As expected, we saw strong moderately significant effects of water depth. Falling water elevations increased abundances of small shorebirds, medium shorebirds, phalaropes (guilds which all use shallow water to forage) and increasing water elevations increased abundance of Eared Grebes and Ruddy Ducks (species which dive to forage). Nevertheless, changes in water elevation proved to be a key management factor driving changes in abundance, in agreement with De La Cruz et al. (2018) who also found water depth was central to guild abundance patterns. Because we lacked bathymetry data for all ponds (it is not available for Cargill-managed ponds) and there were many missing staff gauge values, we could not include true water depth as a variable in our model. We therefore used observed change in water elevation (i.e., change in staff gauge value) as a proxy for water depth. Nevertheless, our model’s statistical power is likely reduced because of this limitation, which may explain why some guilds did not show significant effects. Recent efforts to update and standardize staff gauges across the SBSPRP footprint should improve our ability to estimate changes in water level, but until bathymetry data can be obtained for all ponds, it will remain not possible to include a true water depth covariate in a region-wide model.

Tidal breaches showed little effect in our dataset, potentially due to small sample sizes (only five ponds could be surveyed post-breach). Small shorebirds were the only focal guild for which De La Cruz et al. (2018) found support for tidal breach improving habitat. Kelly & Condeso (2017) also observed a steady increase in shorebird abundance following tidal marsh restoration, which reached a threefold increase 8-years post breach. They found little influence of restoration outside of the immediate area of restoration, though we did not assess spillover effects of tidal restoration on nearby ponds.

Higher levels of dissolved oxygen had significant positive effects on Ruddy Ducks. Changes in dissolved oxygen can have cascading and complex effects on prey relative abundance and trophic webs (for an extreme example, see Takekawa et al. 2015). The earlier report (Van Schmidt & Parsons 2024a) found divergent effects on guilds, which may reflect different optimal dissolved oxygen levels for different key prey items of each foraging guild. A negative relationship with dissolved oxygen was also previously found as a strong relationship for phalaropes (Van Schmidt & Parsons 2024a) but was not in the top model of the revised approach used in this study. Nevertheless, it warrants further examination as an alternative hypothesis for their decline.

The remaining covariates tested generally generally had weak effects in models. Water temperature and pH may fluctuate together seasonally, potentially complicating inference, though Ruddy Ducks did show a strong effect of pH. We found little support for the influence of static pond characteristics on our change model, but De La Cruz et al. (2018) found these could be key drivers of abundance and habitat selection. Our model assessed drivers of changes in abundance, not habitat suitability overall; it is unsurprising that pond characteristics that were static did not cause changes. These features may still drive overall suitability of ponds, however, so we recommend that inferences about the value of pond area, islands, and other static characteristics be based on De La Cruz et al. (2018).

Tidal Marsh Restoration

The separation of tidally restored ponds from SBSPRP-managed wildlife ponds in the trend analysis showed that for most taxa, tidal ponds have had low or declining abundances; the exceptions are dabbling ducks and medium shorebirds. Surprisingly, despite an early increase in abundance of small shorebirds within these ponds from roughly 2010-2014, we found new evidence of strong declines of small shorebirds within tidally breached ponds, the only effect of breaches in our dataset. In contrast, De La Cruz et al. (2018) found higher abundance of small shorebirds in breached ponds. There are three potential explanations for this finding.

One explanation is that the evolution of habitats within breached ponds in the near decade since data collection in the earlier study has rendered them less suitable. Such a hypothesis is plausible because it is anticipated that, in the years following breaching to restore tidal action, mudflats will generally evolve into vegetated tidal marsh that is unsuitable foraging habitat for small shorebirds (Athearn et al. 2009). De La Cruz et al. (2018) analyzed data from 2002–2015, with the 4 oldest breached ponds in the final year of data collection only 9 years old, and the remaining 7 ponds are only 3–5 years old. In nearby Tomales Bay, studies up to eight years after tidal marsh restoration found benefits to shorebirds, but even these leveled out by the end of the study (Kelly & Condeso 2017), and more recent analyses have suggested the benefits of tidal restoration for shorebirds were short term (Warnock et al., 2021). Thus, given that we now have data for some restored ponds nearly twenty years post breach, it is possible we are detecting the new signals of the eventual decline of habitat suitability for small shorebirds.

An alternative explanation is that tidal marsh restoration has reduced our ability to detect waterbirds, including small shorebirds. The increasing vegetation cover and height may be reducing field surveyor's ability to sight small shorebirds within the remaining mudflats. This effect presumably explains at least a part of the declines observed in most taxa in the long-term trends analyses. In addition, because our surveys are conducted at or near high tide, they may underestimate small shorebird use of tidally restored ponds, which is likely higher during low tide when mudflats are exposed. Additional low tide surveys have begun in 2024–2025 which could help better model impacts. Given the finding that change in small shorebird abundance has switched from positive to negative in breached ponds over time, these surveys should be continued.

Additional field data and focused modeling efforts are needed to draw accurate conclusions about how breaching ponds to restore tidal action is affecting waterbird species long term. The confidence intervals on the negative effect of tidal breaches on small shorebird population changes were very wide (Fig. 54). Our analysis of tidal breach impacts is not robust due to data limitations, with only five breached ponds in the model (A17, A19, A20, A21, and E8X). Of these, A20 and A21 have not been surveyed since 2013. Post breach accessibility limitations have prevented water quality sampling at two more breached ponds (E8AE and E8AW) and have also prevented two other breached ponds from being surveyed at all (E10X and A6N). Ponds are also drawn down before breaching, which could also temporarily increase small shorebird use the year before breaching, complicating inference in our year to year analysis model. There may be more complex changes as the hydrology and vegetation of the ponds changes as they are drawn down, breached, and gradually flooded, which our current binary breached vs. not breached variable did not capture. A time since breach effect or year before breach effect might also benefit future analysis. Because of these limitations and sampling biases, our current analysis is better suited to assessing changes in managed ponds than in tidally restored wetlands.

Weather

The current year experienced unusually severe declines in most guilds. During 2023–2024, California experienced a "historically strong" El Niño. One hypothesis is therefore that weather patterns disrupted early migration and pushed birds out of San Francisco Bay and into the Central Valley to take advantage of widespread inundation, as has been observed in shorebird studies. In winter and spring of 2023, California experienced unusually severe winter storms that delayed breeding in many species, which could also explain some of this decline if impacts to populations were lagged.

While our findings confirmed that annual weather plays a role in driving observed trends in abundance—six of the eight species/guilds we assessed show impacts from weather, and each of the five variables we assessed was supported in at least one top model—it did not support the hypothesis that the strong El Niño drove the decline. Many guilds/species were predicted to increase in abundance in response to weather conditions over the past year, while management conditions were predicted to drive the observed declines.

Precipitation had a divergent relationship with duck guilds **(Figs. 8, 13)** and a negative one with small shorebirds and phalaropes **(Figs. 44, 54)**. During the California drought from 2013–2015, drying wetlands in the Central Valley correlated to decreases in both Central Valley and San Francisco Bay populations of yellowlegs (*Tringa* spp.) and dowitchers (*Limnodromus* spp.), but evidence of a shift in distribution from the Central Valley to the San Francisco Bay in Dunlin (*Calidris alpine*; Barbaree et al. 2020). Our results partially concurred with this finding, with precipitation decreases strongly predicting increases in small shorebirds (or vice versa). Conversely, precipitation effects could be the result of birds moving inland to escape winter storms; Warnock and Takekawa (1995) documented shifts in Dunlin from coastal wetlands to inland wetlands in rainy years.

In contrast to the earlier report, we found strong evidence for greater diving duck abundance in temperate years (Fig. 13), and warmer maximum temperatures were associated with greater medium shorebird abundance (Fig. 49). Bonaparte's Gull only significant relationship was also an inverse relationship with change in water temperature (Fig. 36), which is influenced by ambient air temperature. There was strong correlation between maximum monthly temperature and precipitation during small shorebirds' fall and spring migration, so the significant relationship with precipitation could alternatively represent the impacts of higher maximum temperatures. However, this seems the less likely explanation given the strong evidence from other studies that drought and winter storms affect annual shorebird distribution patterns along the Pacific Flyway.

Additional Considerations for Future Study

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

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

Ultimately, monitoring of declines is only useful if the drivers of the declines can be diagnosed and management can be altered to reverse those declines. While monitoring is crucial, better habitat information is also needed to understand how to manage ponds. Water level and quality parameters likely affected prey availability of foraging birds and contributed, at least in part, to observed guild distribution patterns (see Velasquez 1992, Warnock et al. 2002, Takekawa et al. 2006). The current report, Scullen et al. (2013), and De La Cruz (2018) all found that pond conditions had positive, negative, and no effects on guild abundances, depending on the guild, parameter, and timeframe. These data could be used to parameterize scenarios of alternative pond management strategies or the impacts of climate change (i.e., warming temperatures and subsequently lower dissolve oxygen concentrations) to assess these potential impacts on waterbirds and more directly inform management. Such an 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.

Additional field data and focused modeling efforts are needed to draw accurate conclusions about how breaching ponds to restore tidal action is affecting waterbird species long-term. Our analysis of tidal breach impacts is likely not robust due to data limitations, with only five breached ponds in the model (A17, A19, A20, A21, and E8X). Of these, A20 and A21 have not been surveyed since 2013. Post-breach accessibility limitations have prevented water quality sampling at two more breached ponds (E8AE and E8AW) two more breached ponds (E10X and A6N) from being surveyed at all. Ponds are also drawn down before breaching, which could also temporarily increase small shorebird use the year before breaching, complicating inference in our year-to-year analysis model. There may be more complex changes as the hydrology and vegetation of the ponds changes as they are drawn down, breached, and gradually flooded, which our current binary breached vs. not-breached variable did not capture. A time-since-breach effect or year-before-breach effect might also benefit future analysis. Because of these limitations and sampling biases, our current analysis is better suited to assessing changes in managed ponds than in tidally restored wetlands. Additional low tide surveys have begun in 2024-2025 which could help better model impacts, and given the surprising finding that breached ponds have had worse change in small shorebird abundance over time, should be continued.

Given that invertebrate sampling for the SBSPRP was first conducted two decades ago (Brand et al. 2014), additional field sampling of prey items could now better test the connection between how changing water quality parameters may alter the quality of ponds as foraging habitat. This would be especially fruitful at ponds that are currently used by Bonaparte’s Gulls and phalaropes, and ponds that these taxa have disappeared from, to try and understand drivers of change. Pilot sampling was carried out successfully at six phalarope ponds this summer. Invertebrate sampling of phalarope ponds vs. non-ponds across a gradient of dissolved oxygen concentrations could assess the hypothesis that shifting dissolved oxygen concentrations are driving the decline in those species.

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. Carefully examine where the mapped changes in habitats correspond to changes in waterbird abundance, especially for ponds identified as low or high outliers in this report and those that have been identified as experiencing significant negative of positive impacts for pond condition changes by the change model. Managers could compare these to known changes in their management practices or other challenges to the ponds to identify potential detrimental or beneficial impacts of these actions.

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

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

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

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

5. Focus new field studies on understanding the local habitat needs of guilds that have passed their management triggers, particularly those habitat characteristics that can be altered by alternative management strategies—with the aim of identifying management solutions that co-benefit both species given the limited acreage of ponds that can be maintained.

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Appendices

Appendix 1. Table describing how species were assigned to foraging guilds. Rails, geese, and flamingos were not analyzed at as a focal foraging guild and are not listed.

Appendix 2. Tables (two per year/season) of guild-specific and total pond and complex waterbird abundance and richness, and year-to-year change and percent change in abundance, for the study period overall and for each of the three seasons. We recommended using these data to better understand the change in density maps.

Appendix 3. Bar graphs (one per complex) of guild-specific waterbird abundance by survey round.

Appendix 4. Tables (one per guild, plus total waterbird sightings) of the percent of bird sightings that were counted on each pond engaging in different behaviors: foraging, roosting on the pond surface, roosting on islands, roosting on levees, or roosting on manmade structures (e.g., blinds, fence posts).

Appendix 5. AICc tables (one per guild) summarizing the model selection results for the regression models relating inter-annual changes in seasonal waterbird abundance to changes in habitats and weather. The final two tables contain the "base" AICc tables for fitting site characteristics for Bonaparte's Gulls and phalaropes (see Van Schmidt and Parsons 2023 for details).

Appendix 6. Table of the mean water quality measures per season and the change in those measures since last year.

Appendix 7. Line graphs (one per set of ponds) of the mean water quality measures during each survey at all ponds acrossing the reporting year: salinity (Figs. A7.1-A7.4), water temperature (Figs. A7.5-A7.8) dissolved oxygen (Figs. A7.9-A7.12), pH (Figs. A7.13-A7.16), and staff gauge reading (Figs. A7.17-A7.20).

Appendix 8. Table of the status of staff gauges within each pond.

Appendix 1

This appendix describes how species were assigned to foraging guilds. Rails, geese, and flamingos were not analyzed at as a focal foraging guild and are not listed.

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

Common Name	Species Code	Scientific Name	Guild
Hooded Merganser	HOME	*Lophodytes cucullatus*	FISHEAT
Horned Grebe	HOGR	*Podiceps auritus*	FISHEAT
Long-tailed Jaeger	LTJA	*Stercorarius longicaudus*	FISHEAT
Pacific Loon	PALO	*Gavia pacifica*	FISHEAT
Pelagic Cormorant	PECO	*Phalacrocorax pelagicus*	FISHEAT
Pied-billed Grebe	PBGR	*Podilymbus podiceps*	FISHEAT
Red-breasted Merganser	RBME	*Mergus serrator*	FISHEAT
Red-necked Grebe	RNGR	*Podiceps grisegena*	FISHEAT
Red-throated Loon	RTLO	*Gavia stellata*	FISHEAT
Unidentified Cormorant	CORM	*Phalacrocorax spp.*	FISHEAT
Unidentified grebe	GREBE	N/A	FISHEAT
Western Grebe	WEGR	*Aechmophorus occidentalis*	FISHEAT
Western Grebe or Clark's Grebe	WEGR/CLGR	*Aechmophorus spp.*	FISHEAT
Bonaparte's Gull	BOGU	*Larus philadelphia*	GULL
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

Common Name	Species Code	Scientific Name	Guild
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 2

This appendix presents tables (two per year/season) of guild-specific and total pond and complex waterbird abundance and richness, and year-to-year change and percent change in abundance, for the study period overall and for each of the three seasons. We recommended using these data to better understand the change in density maps.

Table A2.1. Waterbird species richness and total sightings in the survey year (September 2023 - May 2024) in South San Francisco Bay, California. RUDU counts are also included in counts of the DIVER guild and BOGU in counts of the GULL guild.

Area	DABB-LER	DIVER	RUDU	EARED GR	FISH-EAT	GULL	BOGU	HERON	PHAL	MED SHORE	SM SHORE	TERN	Total	Rich-ness
A1	1887	10731	5403	35	366	245	7	79	0	4	1	89	13451	36
A10	487	3928	2422	51	337	52	0	32	0	15	30	70	5004	45
A11	94	3349	296	7	224	57	0	14	0	52	52	268	4123	42
A12	1	0	0	0	0	3957	0	0	0	2	0	2	3962	10
A13	34	250	0	3	5	1038	0	0	1	117	3711	0	5165	21
A14	15541	3763	2253	346	830	488	0	37	0	314	18	810	22158	42
A15	2	0	0	0	0	765	0	0	0	52	4015	3	4850	16
A16	14628	1696	1199	39	897	1108	1	299	0	887	452	587	20694	52
A17	2933	435	84	0	5	925	0	20	0	674	64	5	5101	34
A19	3944	92	58	0	0	3008	0	6	0	779	12	0	7892	22
A22	116	26	1	0	0	1340	0	2	0	1264	1895	6	4666	26
A23	0	0	0	0	0	2483	0	0	0	1765	200	0	4462	16
A2E	202	7380	6944	79	52	3292	134	53	0	17	38	34	11154	36
A2W	145	8380	3465	33	653	273	0	84	0	34	107	65	9801	38
A3N	149	480	400	0	15	5	0	63	0	1629	501	30	2882	25
A3W	8939	15098	13715	175	612	306	121	103	0	12	78	103	25438	41
A5	2364	6993	2109	164	1173	2288	696	64	900	65	267	29	14332	53
A6S	591	43	43	0	0	1	0	24	0	41	21	0	727	15
A7	7353	2882	569	27	606	2935	169	31	377	95	334	14	14664	47
A8	676	2020	1145	546	543	1332	0	53	0	108	154	56	5511	44
A8S	411	1554	948	338	258	1238	6	54	0	115	91	66	4160	46
A8W	789	148	128	58	159	507	99	14	0	40	3	154	1877	33
A9	8451	3060	2947	4	320	181	26	28	678	6875	3727	66	23390	42
AB1	2473	4406	4323	0	93	79	0	58	0	4878	643	63	12696	34
AB2	7621	1334	1141	6	188	2604	0	81	0	1298	1229	13	14379	43
Alviso Total	79831	78048	49593	1911	7336	30507	1259	1199	1956	21132	17643	2533	242539	78

Area	DABB-L ER	DIVER	RUDU	EARED GR	FISH-E AT	GULL	BOGU	HERON	PHAL	MED SHORE	SM SHORE	TERN	Total	Rich-ness
N1A	609	1455	322	0	432	191	0	95	0	915	288	136	4140	44
N2A	925	6638	3722	49	579	1719	0	23	0	481	58	31	10513	35
N3A	2149	2314	1254	1	1575	3786	135	191	1	929	3703	64	14728	41
N4	0	207	155	0	65	329	0	26	0	3367	309	20	4332	25
N4AA	1211	2371	1424	4	553	201	50	80	0	249	2370	512	7566	41
N4AB	5265	2729	1668	46	2678	1973	47	178	0	50	60	65	13067	40
N4B	552	410	142	1	1	2	0	40	0	924	1260	1	3193	27
N5	98	149	134	0	178	80	0	32	0	118	70	36	770	24
N6	16	314	67	0	118	1603	0	15	0	12	903	9	2991	25
N7	93	1091	442	13	170	2457	0	32	0	75	672	153	4778	29
N8	28	357	188	0	75	337	0	29	0	11	720	1	1938	27
N9	158	1035	609	0	677	2585	2	26	0	214	1893	5	6603	33
C. Hills Total	11104	19070	10127	114	7101	15263	234	767	1	7345	12306	1033	74619	58
N1	5327	1306	119	338	8	2430	2096	2	21	769	771	11	11001	29
N2	37	36	2	16	4	21	0	10	0	29	30	1	220	19
N3	29	67	2	7	42	73	0	27	0	1504	884	20	2660	29
NPP1	3632	223	42	720	2	572	258	4	2	1800	7801	0	14792	28
Dumb. Total	9025	1632	165	1081	56	3096	2354	43	23	4102	9486	32	28673	42
CP3C	3022	1156	1002	1	37	819	26	42	0	1789	7422	110	14502	39
E1	36	3169	1534	0	319	156	0	26	0	559	197	103	4571	34
E10	1128	3377	2650	0	151	60	49	128	0	1472	633	66	7015	39
E11	184	430	30	0	38	5	0	16	0	1142	223	6	2052	26
E12	3337	803	210	3	100	161	1	128	410	2942	6379	215	14480	45
E13	889	413	346	2	4	75	0	19	1121	1494	14999	2	19018	40
E14	43	0	0	0	0	1	0	16	3	132	17851	1	18055	22
E1C	278	126	2	0	0	0	0	7	0	786	1696	0	2893	22
E2	1300	3458	2670	1	221	89	11	222	43	886	7494	125	13854	51
E2C	641	4	1	0	0	6	0	18	0	559	4185	2	5416	27
E4	1411	272	15	0	17	49	0	91	0	1975	1413	6	5238	32
E4C	252	358	63	0	1	144	0	3	0	2146	12070	0	14981	25
E5	2064	82	45	3	0	227	0	1	1047	1396	154	28	5005	23
E5C	1309	97	0	0	0	3	0	9	1	772	4898	7	7098	25
E6	457	280	181	7	0	90	0	0	342	286	1750	0	3238	26
E6A	2944	4681	4235	8	63	208	0	56	0	957	6670	36	15664	47

Area	DABB-LER	DIVER	RUDU	EARED GR	FISH-EAT	GULL	BOGU	HERON	PHAL	MED SHORE	SM SHORE	TERN	Total	Rich-ness
E6B	689	1976	1867	0	1	33	0	8	0	1265	11259	4	15236	32
E6C	1575	87	27	2	0	46	44	2	0	1330	987	7	4037	24
E7	4047	560	14	0	81	18	7	60	43	801	242	619	6471	34
E8	1466	369	183	0	0	2	0	19	24	3103	1880	2	6887	35
E8AE	48	30	0	0	1	1	0	9	0	430	913	0	1432	19
E8AW	380	16	0	0	2	4	0	13	0	1220	7	2	1644	18
E8XN	20	659	334	0	7	0	0	13	0	1	0	5	705	16
E8XS	48	2	0	0	0	0	0	5	0	1	50	0	106	9
E9	3078	157	11	0	18	5	0	59	0	2137	3986	0	9441	34
Eden Total	30646	22562	15420	27	1061	2202	138	970	3034	29581	107358	1346	199039	72
M1	3489	665	641	4885	6	1918	0	1	0	2902	13147	0	27067	28
M2	16120	836	263	4546	2	2090	0	1	75	2816	12898	6	39410	28
M3	3598	465	51	8519	0	1901	0	1	0	2150	10963	0	27611	27
M4	1645	370	3	4789	0	2420	0	3	0	65	596	0	9900	20
M5	282	98	0	1382	0	1807	0	0	0	118	6732	0	10423	19
M6	5	882	0	50	0	365	0	0	0	18	6157	0	7484	20
Mowry Total	25139	3316	958	24171	8	10501	0	6	75	8069	50493	6	121895	43
R1	392	895	592	2	222	28	0	146	0	1589	51161	54	54519	40
R2	13	175	0	0	0	124	1	1	12	282	19684	7	20300	23
R3	616	334	0	2	2	0	0	9	0	332	165	13	1559	24
R4	13	0	0	0	1	29	0	6	0	450	6166	62	6752	20
R5	47	1	0	0	0	0	0	4	0	89	430	0	697	18
R5S	45	8	0	0	0	0	0	3	0	77	140	0	287	14
RSF2U1	1270	642	113	2	52	436	0	84	0	11798	2706	299	17298	41
RSF2U2	1397	345	244	0	150	387	0	31	0	6705	1628	286	10947	40
RSF2U3	32	130	0	0	1	73	0	0	0	110	1616	0	1971	21
RSF2U4	32	1603	1492	0	25	0	0	6	0	24	32	2	1731	20
Raven. Total	3857	4133	2441	6	453	1077	1	290	12	21456	83728	723	116061	54
Grand Total	159602	128761	78704	27310	16015	62646	3986	3275	5101	91685	281014	5673	782826	87

Table A2.2. Change in waterbird species richness and total sightings in the survey year (September 2023 - May 2024 compared to September 2022 - May 2023) in South San Francisco Bay, California. Percent change from the previous year is listed in parentheses; New indicates sites that were new colonizations (zero abundance in the previous period). Sites that were unoccupied by a guild in both periods are listed as Unused. RUDU counts are also included in counts of the DIVER guild and BOGU in counts of the GULL guild.

Area	DABBLER	DIVER	RUDU	EARED GR	FISHEAT	GULL	BOGU	HERON	PHAL	MEDSHOR	SMSHOR	TERN	Total	Rich-ness
A1	-1428 (-43%)	-1074 (-9%)	-724 (-12%)	-38 (-52%)	+46 (+14%)	+85 (+53%)	+7 (New)	+27 (+52%)	Unused	+1 (+33%)	+1 (New)	+65 (+271%)	-2316 (-15%)	+2 (+6%)
A10	+335 (+220%)	-907 (-19%)	-1652 (-41%)	+24 (+89%)	-112 (-25%)	-179 (-77%)	Unused	-43 (-57%)	Unused	+3 (+25%)	-117 (-80%)	-24 (-26%)	-1020 (-17%)	+3 (+7%)
A11	+36 (+62%)	-5406 (-62%)	-1815 (-86%)	-128 (-95%)	-1113 (-83%)	-136 (-70%)	Unused	-43 (-75%)	Unused	+0 (+0%)	-21 (-29%)	+217 (+425%)	-6591 (-62%)	+5 (+14%)
A12	+1 (New)	Unused	Unused	Unused	Unused	-1302 (-25%)	Unused	Unused	Unused	-47 (-96%)	-45 (-100%)	+2 (New)	-1392 (-26%)	-3 (-23%)
A13	+13 (+62%)	-271 (-52%)	-14 (-100%)	-75 (-96%)	+1 (+25%)	-1324 (-56%)	Unused	Unused	+1 (New)	-2 (-2%)	-4039 (-52%)	-11 (-100%)	-5701 (-52%)	-3 (-12%)
A14	+759 (+5%)	-12851 (-77%)	-1236 (-35%)	+75 (+28%)	-164 (-16%)	+179 (+58%)	-8 (-100%)	-36 (-49%)	Unused	-27 (-8%)	-397 (-96%)	+418 (+107%)	-12040 (-35%)	+1 (+2%)
A15	-1 (-33%)	-80 (-100%)	Unused	-15 (-100%)	Unused	-2172 (-74%)	Unused	-7 (-100%)	Unused	+23 (+79%)	-6974 (-63%)	+1 (+50%)	-9219 (-66%)	-9 (-36%)
A16	-6505 (-31%)	-5203 (-75%)	-4673 (-80%)	-18 (-32%)	-373 (-29%)	-202 (-15%)	-9 (-90%)	+106 (+55%)	Unused	-80 (-8%)	-2778 (-86%)	-59 (-9%)	-15043 (-42%)	-1 (-2%)
A17	-1274 (-30%)	-60 (-12%)	-76 (-48%)	-3 (-100%)	-21 (-81%)	+683 (+282%)	Unused	+14 (+233%)	Unused	-2231 (-77%)	-643 (-91%)	+5 (New)	-3497 (-41%)	-2 (-6%)
A19	-990 (-20%)	+76 (+475%)	+58 (New)	Unused	-1 (-100%)	+1119 (+59%)	Unused	+4 (+200%)	Unused	-162 (-17%)	-28 (-70%)	Unused	+30 (+0%)	+6 (+38%)
A22	-865 (-88%)	-91 (-78%)	-12 (-92%)	-1 (-100%)	Unused	-445 (-25%)	-1 (-100%)	+2 (New)	-10 (-100%)	-1056 (-46%)	-668 (-26%)	+6 (New)	-3136 (-40%)	-1 (-4%)
A23	-5 (-100%)	-21 (-100%)	Unused	Unused	Unused	-460 (-16%)	Unused	-3 (-100%)	Unused	+1195 (+210%)	-1270 (-86%)	Unused	-565 (-11%)	-5 (-24%)
A2E	-12422 (-98%)	-3091 (-30%)	-1035 (-13%)	+14 (+22%)	-365 (-88%)	+1460 (+80%)	+98 (+272%)	-42 (-44%)	Unused	-124 (-88%)	-624 (-94%)	-63 (-65%)	-15261 (-58%)	+0 (+0%)
A2W	-1386 (-91%)	-4112 (-33%)	-2302 (-40%)	-40 (-55%)	-426 (-39%)	+241 (+753%)	Unused	+49 (+140%)	Unused	+16 (+89%)	-34 (-24%)	-233 (-78%)	-5919 (-38%)	-2 (-5%)
A3N	-200 (-57%)	+313 (+187%)	+268 (+203%)	-3 (-100%)	+12 (+400%)	-187 (-97%)	Unused	+51 (+425%)	Unused	-357 (-18%)	-7678 (-94%)	+26 (+650%)	-8015 (-74%)	-5 (-17%)
A3W	+2556 (+40%)	-1767 (-10%)	+530 (+4%)	+51 (+41%)	-407 (-40%)	-490 (-62%)	+120 (+12000%)	+12 (+13%)	Unused	-948 (-99%)	-5885 (-99%)	-67 (-39%)	-6935 (-21%)	-3 (-7%)
A5	+41 (+2%)	-7900 (-53%)	-3617 (-63%)	-11 (-6%)	-115 (-9%)	-3340 (-59%)	+696 (New)	-35 (-35%)	+900 (New)	-114 (-64%)	-82 (-23%)	-71 (-71%)	-10732 (-43%)	+8 (+18%)
A6S	-378 (-39%)	-25 (-37%)	-21 (-33%)	Unused	-1 (-100%)	-39 (-98%)	Unused	+9 (+60%)	Unused	-965 (-96%)	-558 (-96%)	Unused	-1955 (-73%)	-8 (-35%)
A7	+6597 (+873%)	-1771 (-38%)	-252 (-31%)	-6 (-18%)	-691 (-53%)	-1278 (-30%)	+169 (New)	-43 (-58%)	+377 (New)	-11 (-10%)	+135 (+68%)	-116 (-89%)	+3181 (+28%)	+4 (+9%)
A8	+42 (+7%)	-12888 (-86%)	-1813 (-61%)	+516 (+1720%)	+354 (+187%)	+225 (+20%)	Unused	+37 (+231%)	Unused	+50 (+86%)	+153 (+15300%)	-318 (-85%)	-11812 (-68%)	+8 (+22%)
A8S	+63 (+18%)	-1648 (-51%)	-1569 (-62%)	+108 (+47%)	+109 (+73%)	-239 (-16%)	+6 (New)	-31 (-36%)	Unused	+79 (+219%)	+72 (+379%)	-314 (-83%)	-1775 (-30%)	+10 (+28%)

Area	DABBLER	DIVER	RUDU	EARED GR	FISHEAT	GULL	BOGU	HERON	PHAL	MEDSHOR	SMSHOR	TERN	Total	Rich-ness
A8W	+709 (+886%)	-24 (-14%)	+12 (+10%)	+26 (+81%)	+80 (+101%)	-254 (-33%)	+99 (New)	+3 (+27%)	Unused	+28 (+233%)	-42 (-93%)	-48 (-24%)	+478 (+34%)	+1 (+3%)
A9	-4286 (-34%)	-905 (-23%)	-923 (-24%)	+4 (New)	+210 (+191%)	-268 (-60%)	+25 (+2500%)	-151 (-84%)	+669 (+7433 %)	-2223 (-24%)	-61720 (-94%)	-35 (-35%)	-68727 (-75%)	-6 (-12%)
AB1	-3651 (-60%)	+3260 (+284%)	+3729 (+628%)	-2 (-100%)	-45 (-33%)	-34 (-30%)	-3 (-100%)	-96 (-62%)	Unused	+3148 (+182%)	-8930 (-93%)	+52 (+473%)	-6298 (-33%)	-12 (-26%)
AB2	+4194 (+122%)	-3447 (-72%)	-2886 (-72%)	-13 (-68%)	-113 (-38%)	-2848 (-52%)	Unused	+9 (+12%)	Unused	-759 (-37%)	-8557 (-87%)	+11 (+550%)	-11519 (-44%)	-2 (-4%)
Alviso Total	-18045 (-18%)	-59893 (-43%)	-20023 (-29%)	+465 (+32%)	-3135 (-30%)	-11205 (-27%)	+1199 (+1998%)	-207 (-15%)	+1937 (+10195 %)	-4563 (-18%)	-110729 (-86%)	-556 (-18%)	-205779 (-46%)	+8 (+11%)
N1A	+548 (+898%)	+27 (+2%)	-316 (-50%)	-2 (-100%)	+47 (+12%)	-103 (-35%)	Unused	+51 (+116%)	Unused	+893 (+4059%)	+278 (+2780%)	-52 (-28%)	+1700 (+70%)	+11 (+33%)
N2A	+893 (+2791%)	+2697 (+68%)	+2368 (+175%)	+33 (+206%)	+70 (+14%)	-897 (-34%)	Unused	+12 (+109%)	Unused	+479 (+23950%)	+52 (+867%)	+19 (+158%)	+3362 (+47%)	+5 (+17%)
N3A	-1882 (-47%)	-6276 (-73%)	-5329 (-81%)	-6 (-86%)	+362 (+30%)	-525 (-12%)	+135 (New)	+162 (+559%)	+1 (New)	+767 (+473%)	+2652 (+252%)	-170 (-73%)	-4911 (-25%)	+2 (+5%)
N4	-8 (-100%)	+126 (+156%)	+151 (+3775%)	-67 (-100%)	+31 (+91%)	+110 (+50%)	Unused	-20 (-43%)	-12 (-100%)	-1478 (-31%)	-404 (-57%)	+14 (+233%)	-1708 (-28%)	-5 (-17%)
N4AA	-4518 (-79%)	-617 (-21%)	+130 (+10%)	+1 (+33%)	-161 (-23%)	+30 (+18%)	+42 (+525%)	+30 (+60%)	Unused	+159 (+177%)	+1820 (+331%)	+22 (+4%)	-3231 (-30%)	-4 (-9%)
N4AB	+1361 (+35%)	-4936 (-64%)	-2432 (-59%)	+16 (+53%)	+2010 (+301%)	-1178 (-37%)	+47 (New)	+137 (+334%)	Unused	+49 (+4900%)	+50 (+500%)	+49 (+306%)	-2426 (-16%)	+6 (+18%)
N4B	-96 (-15%)	+127 (+45%)	-37 (-21%)	+1 (New)	-163 (-99%)	-864 (-100%)	Unused	-33 (-45%)	Unused	+885 (+2269%)	+1186 (+1603%)	+1 (New)	+1042 (+48%)	+7 (+35%)
N5	+57 (+139%)	+59 (+66%)	+113 (+538%)	Unused	+47 (+36%)	-190 (-70%)	Unused	+24 (+300%)	Unused	+99 (+521%)	-149 (-68%)	+34 (+1700%)	-20 (-3%)	+7 (+41%)
N6	-189 (-92%)	-859 (-73%)	-972 (-94%)	-1 (-100%)	+86 (+269%)	-3431 (-68%)	Unused	-1 (-6%)	Unused	-18 (-60%)	-130 (-13%)	+7 (+350%)	-4537 (-60%)	-1 (-4%)
N7	+64 (+221%)	-652 (-37%)	-1261 (-74%)	-1 (-7%)	-102 (-38%)	-505 (-17%)	-9 (-100%)	+9 (+39%)	Unused	+74 (+7400%)	+599 (+821%)	+147 (+2450%)	-353 (-7%)	+4 (+16%)
N8	-21 (-43%)	+188 (+111%)	+46 (+32%)	-2 (-100%)	-114 (-60%)	-405 (-55%)	Unused	+13 (+81%)	Unused	-256 (-96%)	+438 (+155%)	-1 (-50%)	+220 (+13%)	+1 (+4%)
N9	-317 (-67%)	+702 (+211%)	+346 (+132%)	Unused	+277 (+69%)	+1308 (+102%)	+2 (New)	+0 (+0%)	Unused	-60 (-22%)	+229 (+14%)	-11 (-69%)	+2132 (+48%)	-1 (-3%)
C. Hills Total	-4108 (-27%)	-9414 (-33%)	-7193 (-42%)	-28 (-20%)	+2390 (+51%)	-6650 (-30%)	+217 (+1276%)	+384 (+100%)	-11 (-92%)	+1593 (+28%)	+6621 (+116%)	+59 (+6%)	-8730 (-10%)	-3 (-5%)
N1	+3244 (+156%)	-3774 (-74%)	-905 (-88%)	-1804 (-84%)	+5 (+167%)	+2219 (+1052%)	+2096 (New)	+0 (+0%)	+21 (New)	-263 (-25%)	-260 (-25%)	+7 (+175%)	-594 (-5%)	+4 (+16%)
N2	-2781 (-99%)	-748 (-95%)	-17 (-89%)	-197 (-92%)	-1 (-20%)	-329 (-94%)	Unused	+7 (+233%)	Unused	-21 (-42%)	-314 (-91%)	+1 (New)	-4368 (-95%)	-4 (-17%)
N3	-4021 (-99%)	-1348 (-95%)	-59 (-97%)	-948 (-99%)	+29 (+223%)	-51 (-41%)	Unused	+19 (+238%)	Unused	-1909 (-56%)	-6583 (-88%)	+18 (+900%)	-14790 (-85%)	-4 (-12%)
NPP1	+3454 (+1940%)	-817 (-79%)	+1 (+2%)	+310 (+76%)	+2 (New)	+242 (+73%)	+258 (New)	+4 (New)	+2 (New)	+709 (+65%)	-14596 (-65%)	Unused	-10658 (-42%)	+5 (+22%)
Dumb. Total	-104 (-1%)	-6687 (-80%)	-980 (-86%)	-2639 (-71%)	+35 (+167%)	+2081 (+205%)	+2354 (New)	+30 (+231%)	+23 (New)	-1484 (-27%)	-21753 (-70%)	+26 (+433%)	-30410 (-51%)	+2 (+5%)
CP3C	-1589 (-34%)	+229 (+25%)	+216 (+27%)	-9 (-90%)	+34 (+1133%)	+273 (+50%)	+26 (New)	+22 (+110%)	-5 (-100%)	+841 (+89%)	-44 (-1%)	+107 (+3567%)	-56 (-0%)	+6 (+18%)

Area	DABBLER	DIVER	RUDU	EARED GR	FISHEAT	GULL	BOGU	HERON	PHAL	MEDSHOR	SMSHOR	TERN	Total	Rich-ness
E1	-674 (-95%)	-1327 (-30%)	-87 (-5%)	-10 (-100%)	-442 (-58%)	+46 (+42%)	Unused	-53 (-67%)	Unused	+249 (+80%)	-210 (-52%)	+50 (+94%)	-2374 (-34%)	+1 (+3%)
E10	+589 (+109%)	+1072 (+47%)	+573 (+28%)	-8 (-100%)	+132 (+695%)	+38 (+173%)	+49 (New)	+79 (+161%)	Unused	-1182 (-45%)	-1238 (-66%)	+32 (+94%)	-490 (-7%)	+1 (+3%)
E11	-1559 (-89%)	-356 (-45%)	-707 (-96%)	Unused	+37 (+3700%)	-263 (-98%)	Unused	-10 (-38%)	Unused	-4732 (-81%)	-3527 (-94%)	+1 (+20%)	-10404 (-84%)	-4 (-13%)
E12	+1074 (+47%)	+188 (+31%)	-25 (-11%)	+0 (+0%)	+60 (+150%)	-79 (-33%)	+0 (+0%)	+76 (+146%)	+410 (New)	+285 (+11%)	-7176 (-53%)	+182 (+552%)	-4980 (-26%)	+4 (+10%)
E13	-369 (-29%)	+218 (+112%)	+247 (+249%)	+0 (+0%)	-15 (-79%)	+74 (+7400%)	Unused	+3 (+19%)	+1121 (New)	+239 (+19%)	+1228 (+9%)	-28 (-93%)	+2471 (+15%)	+7 (+21%)
E14	+31 (+258%)	-1 (-100%)	Unused	Unused	Unused	+1 (New)	Unused	+14 (+700%)	+0 (+0%)	+112 (+560%)	+5480 (+44%)	-5 (-83%)	+5631 (+45%)	+2 (+10%)
E1C	-647 (-70%)	+106 (+530%)	-2 (-50%)	Unused	Unused	-6 (-100%)	Unused	+3 (+75%)	Unused	+339 (+76%)	-3541 (-68%)	Unused	-3753 (-56%)	+1 (+5%)
E2	-1097 (-46%)	-8607 (-71%)	-4880 (-65%)	-9 (-90%)	-16 (-7%)	-82 (-48%)	+11 (New)	+167 (+304%)	-1013 (-96%)	+359 (+68%)	+6363 (+563%)	+11 (+10%)	-3921 (-22%)	+12 (+31%)
E2C	+98 (+18%)	-1 (-20%)	-2 (-67%)	Unused	Unused	+4 (+200%)	Unused	+10 (+125%)	Unused	+138 (+33%)	+2515 (+151%)	+2 (New)	+2765 (+104%)	+1 (+4%)
E4	-8725 (-86%)	-189 (-41%)	-424 (-97%)	Unused	-20 (-54%)	-89 (-64%)	Unused	+80 (+727%)	-2611 (-100%)	+606 (+44%)	-16169 (-92%)	-9 (-60%)	-27143 (-84%)	-3 (-9%)
E4C	-1454 (-85%)	+189 (+112%)	-52 (-45%)	-2 (-100%)	+1 (New)	-243 (-63%)	-13 (-100%)	+3 (New)	Unused	+5 (+0%)	-6601 (-35%)	Unused	-8132 (-35%)	+0 (+0%)
E5	+736 (+55%)	-935 (-92%)	-56 (-55%)	-4 (-57%)	-65 (-100%)	+3 (+1%)	-193 (-100%)	-4 (-80%)	+1047 (New)	+297 (+27%)	-950 (-86%)	+15 (+115%)	+137 (+3%)	-6 (-21%)
E5C	+79 (+6%)	+51 (+111%)	Unused	Unused	Unused	-186 (-98%)	Unused	+9 (New)	-147 (-99%)	+6 (+1%)	+2295 (+88%)	+7 (New)	+2091 (+42%)	+8 (+47%)
E6	-1875 (-80%)	-442 (-61%)	-263 (-59%)	-153 (-96%)	-2 (-100%)	-581 (-87%)	Unused	-1 (-100%)	+108 (+46%)	-1596 (-85%)	-1366 (-44%)	Unused	-5890 (-65%)	-3 (-10%)
E6A	-2192 (-43%)	-2661 (-36%)	-2252 (-35%)	-41 (-84%)	+3 (+5%)	+4 (+2%)	Unused	-25 (-31%)	Unused	-20 (-2%)	-11560 (-63%)	-2 (-5%)	-16480 (-51%)	+1 (+2%)
E6B	-15 (-2%)	+1328 (+205%)	+1364 (+271%)	-33 (-100%)	+0 (+0%)	+30 (+1000%)	Unused	-11 (-58%)	-118 (-100%)	+148 (+13%)	-2910 (-21%)	+1 (+33%)	-1584 (-9%)	+0 (+0%)
E6C	+1346 (+588%)	-70 (-45%)	+26 (+2600%)	+1 (+100%)	-1 (-100%)	+45 (+4500%)	+44 (New)	+0 (+0%)	Unused	+1330 (New)	+467 (+90%)	-4 (-36%)	+3111 (+336%)	+7 (+41%)
E7	+3349 (+480%)	-8920 (-94%)	-9146 (-100%)	-10 (-100%)	-354 (-81%)	-35 (-66%)	+7 (New)	+40 (+200%)	+14 (+48%)	+476 (+146%)	-176 (-42%)	-139 (-18%)	-5764 (-47%)	-3 (-8%)
E8	-528 (-26%)	-774 (-68%)	-610 (-77%)	-7 (-100%)	-7 (-100%)	-3 (-60%)	Unused	+2 (+12%)	-17 (-41%)	+1056 (+52%)	-7790 (-81%)	+2 (New)	-8044 (-54%)	+3 (+9%)
E8AE	-261 (-84%)	+30 (New)	Unused	Unused	+1 (New)	-1 (-50%)	Unused	+2 (+29%)	Unused	-378 (-47%)	-2179 (-70%)	Unused	-2788 (-66%)	+2 (+12%)
E8AW	+320 (+533%)	-31 (-66%)	Unused	Unused	+1 (+100%)	+4 (New)	Unused	+1 (+8%)	Unused	-1675 (-58%)	-5391 (-100%)	-1 (-33%)	-6772 (-80%)	-1 (-5%)
E8XN	+12 (+150%)	-128 (-16%)	-320 (-49%)	Unused	+2 (+40%)	Unused	Unused	+0 (+0%)	Unused	+0 (+0%)	Unused	+4 (+400%)	-110 (-13%)	+2 (+14%)
E8XS	-64 (-57%)	+2 (New)	Unused	Unused	Unused	Unused	Unused	+2 (+67%)	Unused	-3 (-75%)	-301 (-86%)	Unused	-366 (-78%)	-4 (-31%)

Area	DABBLER	DIVER	RUDU	EARED GR	FISHEAT	GULL	BOGU	HERON	PHAL	MEDSHOR	SMSHOR	TERN	Total	Rich-ness
E9	-879 (-22%)	-259 (-62%)	+8 (+267%)	Unused	+7 (+64%)	-239 (-98%)	Unused	+38 (+181%)	Unused	-10290 (-83%)	-22919 (-85%)	-13 (-100%)	-34557 (-79%)	+1 (+3%)
Eden Total	-14294 (-32%)	-21288 (-49%)	-16392 (-52%)	-285 (-91%)	-644 (-38%)	-1285 (-37%)	-69 (-33%)	+447 (+85%)	-1211 (-29%)	-13390 (-31%)	-75700 (-41%)	+213 (+19%)	-127402 (-39%)	+5 (+7%)
M1	+3003 (+618%)	-1071 (-62%)	-179 (-22%)	+4737 (+3201%)	-84 (-93%)	+335 (+21%)	Unused	-8 (-89%)	-19 (-100%)	-644 (-18%)	-4770 (-27%)	-147 (-100%)	+1367 (+5%)	-2 (-7%)
M2	+15978 (+11252%)	+445 (+114%)	-71 (-21%)	+4095 (+908%)	-52 (-96%)	-1129 (-35%)	-1 (-100%)	+0 (+0%)	-416 (-85%)	-2070 (-42%)	-7974 (-38%)	-162 (-96%)	+8733 (+28%)	-7 (-20%)
M3	+2583 (+254%)	+443 (+2014%)	+49 (+2450%)	-252 (-3%)	-3 (-100%)	-267 (-12%)	-120 (-100%)	+1 (New)	Unused	+1703 (+381%)	+8861 (+422%)	-2 (-100%)	+13077 (+90%)	+3 (+12%)
M4	-1488 (-47%)	+198 (+115%)	-20 (-87%)	-14425 (-75%)	Unused	-1567 (-39%)	-76 (-100%)	+3 (New)	-11 (-100%)	-189 (-74%)	-226 (-27%)	Unused	-17703 (-64%)	+0 (+0%)
M5	-4154 (-94%)	-525 (-84%)	-10 (-100%)	-7763 (-85%)	Unused	-1228 (-40%)	-1084 (-100%)	Unused	Unused	-281 (-70%)	+6558 (+3769%)	Unused	-7392 (-41%)	+0 (+0%)
M6	-1003 (-100%)	+856 (+3292%)	Unused	-6054 (-99%)	Unused	-548 (-60%)	-1 (-100%)	Unused	-90 (-100%)	-1126 (-98%)	+3819 (+163%)	Unused	-4144 (-36%)	+4 (+25%)
Mowry Total	+14919 (+146%)	+346 (+12%)	-231 (-19%)	-19662 (-45%)	-139 (-95%)	-4404 (-30%)	-1282 (-100%)	-4 (-40%)	-536 (-88%)	-2607 (-24%)	+6268 (+14%)	-311 (-98%)	-6062 (-5%)	-1 (-2%)
R1	+145 (+59%)	-704 (-44%)	-223 (-27%)	-11 (-85%)	-45 (-17%)	-867 (-97%)	Unused	-35 (-19%)	-162 (-100%)	-5777 (-78%)	-69341 (-58%)	-52 (-49%)	-76826 (-58%)	-4 (-9%)
R2	-21 (-62%)	-340 (-66%)	-1 (-100%)	-4 (-100%)	Unused	+42 (+51%)	+1 (New)	-1 (-50%)	+6 (+100%)	-446 (-61%)	+19044 (+2976%)	+5 (+250%)	+18280 (+905%)	+2 (+10%)
R3	+591 (+2364%)	+197 (+144%)	Unused	-4 (-67%)	-2 (-50%)	-1 (-100%)	Unused	+9 (New)	Unused	-608 (-65%)	-4784 (-97%)	+13 (New)	-4532 (-74%)	+3 (+14%)
R4	-1254 (-99%)	-891 (-100%)	Unused	-27 (-100%)	+1 (New)	+15 (+107%)	Unused	+6 (New)	-15 (-100%)	-1617 (-78%)	-6258 (-50%)	+58 (+1450%)	-9981 (-60%)	-8 (-29%)
R5	-31 (-40%)	+1 (New)	Unused	Unused	Unused	Unused	Unused	-4 (-50%)	Unused	+46 (+107%)	+154 (+56%)	-1 (-100%)	+272 (+64%)	+3 (+20%)
R5S	-199 (-82%)	+7 (+700%)	Unused	Unused	Unused	Unused	Unused	+0 (+0%)	Unused	+14 (+22%)	-1210 (-90%)	-1 (-100%)	-1375 (-83%)	-3 (-18%)
RSF2U1	+347 (+38%)	+11 (+2%)	-72 (-39%)	+1 (+100%)	+32 (+160%)	-321 (-42%)	Unused	+48 (+133%)	Unused	+6394 (+118%)	+1904 (+237%)	+185 (+162%)	+8603 (+99%)	+6 (+17%)
RSF2U2	-6567 (-82%)	-484 (-58%)	-418 (-63%)	-1 (-100%)	+102 (+212%)	+155 (+67%)	Unused	+4 (+15%)	Unused	-7915 (-54%)	+1176 (+260%)	-46 (-14%)	-13566 (-55%)	+4 (+11%)
RSF2U3	+26 (+433%)	-5 (-4%)	Unused	Unused	+1 (New)	+60 (+462%)	Unused	-2 (-100%)	Unused	-19 (-15%)	-4244 (-72%)	Unused	-4182 (-68%)	-1 (-5%)
RSF2U4	-223 (-87%)	+328 (+26%)	+439 (+42%)	-4 (-100%)	+24 (+2400%)	-1 (-100%)	Unused	-7 (-54%)	Unused	-267 (-92%)	-1407 (-98%)	-2 (-50%)	-1556 (-47%)	-12 (-38%)
Raven. Total	-7186 (-65%)	-1880 (-31%)	-275 (-10%)	-50 (-89%)	+113 (+33%)	-918 (-46%)	+1 (New)	+18 (+7%)	-171 (-93%)	-10195 (-32%)	-64966 (-44%)	+159 (+28%)	-84863 (-42%)	-3 (-5%)
Grand Total	-28818 (-15%)	-98816 (-43%)	-45094 (-36%)	-22199 (-45%)	-1380 (-8%)	-22381 (-26%)	+2420 (+155%)	+668 (+26%)	+31 (+1%)	-30646 (-25%)	-260259 (-48%)	-410 (-7%)	-463246 (-37%)	+4 (+5%)

Table A2.3. Waterbird species richness and total sightings in fall (September 2023 - November 2023) in South San Francisco Bay, California. RUDU counts are also included in counts of the DIVER guild and BOGU in counts of the GULL guild.

Area	DABB-LER	DIVER	RUDU	EARED GR	FISH-EAT	GULL	BOGU	HERON	PHAL	MED SHOR	SM SHOR	TERN	Total	Rich-ness
A1	155	3793	2259	12	209	190	7	51	0	3	1	44	4458	30
A10	73	867	130	0	204	11	0	16	0	13	15	62	1261	28
A11	6	2628	155	0	142	29	0	6	0	8	40	263	3122	26
A12	0	0	0	0	0	3102	0	0	0	0	0	2	3104	5
A13	0	0	0	0	5	456	0	0	1	0	539	0	1001	5
A14	3862	1035	798	2	389	406	0	12	0	127	17	729	6579	33
A15	0	0	0	0	0	188	0	0	0	0	557	3	748	6
A16	3189	376	330	17	701	660	1	221	0	464	438	22	6090	44
A17	776	9	8	0	0	3	0	13	0	142	1	0	945	15
A19	2206	1	0	0	0	286	0	4	0	367	6	0	2870	9
A22	0	0	0	0	0	0	0	0	0	0	9	0	9	1
A23	0	0	0	0	0	235	0	0	0	0	0	0	235	5
A2E	30	1414	1399	16	11	30	0	26	0	12	20	2	1561	24
A2W	48	3309	1426	20	187	192	0	32	0	23	8	7	3826	32
A3N	0	0	0	0	0	3	0	2	0	1070	335	1	1411	11
A3W	427	5140	5129	12	54	67	0	28	0	6	57	2	5801	26
A5	983	2095	726	13	429	53	0	16	0	49	177	19	3834	43
A6S	148	1	1	0	0	1	0	20	0	0	0	0	170	9
A7	5219	2118	288	9	302	32	0	10	0	83	248	10	8032	37
A8	496	542	236	2	434	320	0	25	0	73	100	48	2040	39
A8S	202	206	137	8	121	31	0	22	0	66	14	63	733	27
A8W	202	5	5	0	94	20	2	5	0	28	3	149	506	23
A9	379	53	18	4	88	14	0	13	678	2909	1639	2	5779	26
AB1	280	1728	1719	0	65	7	0	11	0	25	10	1	2127	20
AB2	3179	436	435	3	134	249	0	51	0	388	36	0	4477	30
Alviso Total	21860	25756	15199	118	3569	6585	10	584	679	5856	4270	1429	70719	66
N1A	313	7	0	0	181	43	0	41	0	311	80	110	1086	24
N2A	916	194	35	4	307	252	0	12	0	344	58	27	2114	28
N3A	50	176	0	0	1282	521	132	175	0	420	1252	20	3898	22
N4	0	0	0	0	35	2	0	2	0	968	252	3	1262	15
N4AA	172	0	0	0	479	155	47	37	0	93	1078	84	2098	27
N4AB	1092	95	0	0	2408	270	47	148	0	43	59	39	4154	25

Area	DABB-LER	DIVER	RUDU	EARED GR	FISH-EAT	GULL	BOGU	HERON	PHAL	MED SHOR	SM SHOR	TERN	Total	Rich-ness
N4B	32	1	0	0	1	0	0	30	0	547	915	0	1526	18
N5	0	4	0	0	41	2	0	3	0	113	47	1	211	9
N6	0	0	0	0	5	0	0	10	0	3	736	3	757	13
N7	13	0	0	0	115	231	0	7	0	74	595	151	1186	16
N8	0	0	0	0	14	9	0	13	0	2	192	1	231	13
N9	0	0	0	0	603	122	0	9	0	42	1306	0	2082	18
C. Hills Total	2588	477	35	4	5471	1607	226	487	0	2960	6570	439	20605	44
N1	1207	24	5	36	3	1186	903	1	5	460	498	0	3420	22
N2	1	10	2	16	0	0	0	5	0	10	17	0	59	9
N3	25	12	2	7	24	66	0	16	0	1370	297	0	1817	18
NPP1	756	106	0	10	1	188	173	2	2	402	2490	0	3957	22
Dumb. Total	1989	152	9	69	28	1440	1076	24	7	2242	3302	0	9253	30
CP3C	5	0	0	0	13	373	26	10	0	267	1491	16	2175	22
E1	1	8	5	0	246	138	0	13	0	57	0	39	502	17
E10	24	44	4	0	135	52	49	113	0	300	118	12	798	22
E11	12	3	0	0	0	0	0	6	0	712	188	2	923	15
E12	264	6	0	1	80	129	0	81	410	1522	3117	66	5676	32
E13	130	8	0	2	1	71	0	4	1121	45	5468	0	6850	24
E14	0	0	0	0	0	0	0	6	3	115	9674	0	9798	16
E1C	100	0	0	0	0	0	0	1	0	615	1119	0	1835	13
E2	54	2	2	0	97	63	0	150	43	276	5672	45	6402	28
E2C	37	0	0	0	0	1	0	8	0	168	1330	1	1545	19
E4	132	0	0	0	15	45	0	55	0	629	950	0	1826	21
E4C	12	0	0	0	0	140	0	0	0	868	2998	0	4018	14
E5	1088	0	0	0	0	227	0	0	1047	1230	101	28	3721	15
E5C	238	0	0	0	0	2	0	0	1	539	653	7	1440	17
E6	95	2	0	2	0	52	0	0	326	15	46	0	559	10
E6A	619	695	542	3	35	88	0	14	0	275	850	0	2579	31
E6B	274	275	209	0	0	2	0	1	0	984	3006	0	4542	17
E6C	168	0	0	0	0	0	0	1	0	0	235	0	404	6
E7	40	4	4	0	59	8	5	39	43	175	141	371	880	23
E8	245	92	2	0	0	2	0	2	24	2255	1141	0	3783	24
E8AE	2	0	0	0	0	0	0	3	0	339	77	0	421	9
E8AW	268	0	0	0	2	3	0	10	0	1199	7	1	1490	12

Area	DABB-LER	DIVER	RUDU	EARED GR	FISH-EAT	GULL	BOGU	HERON	PHAL	MED SHOR	SM SHOR	TERN	Total	Rich-ness
E8XN	1	0	0	0	1	0	0	6	0	0	0	0	8	3
E8XS	0	0	0	0	0	0	0	3	0	1	0	0	4	4
E9	2	0	0	0	1	2	0	41	0	1629	177	0	1852	14
Eden Total	3811	1139	768	8	685	1398	80	567	3018	14215	38559	588	64031	53
M1	1460	18	18	2252	3	308	0	0	0	2064	9914	0	16019	17
M2	8602	70	36	1111	2	145	0	1	75	560	10304	1	20871	19
M3	1507	0	0	3165	0	80	0	0	0	449	2300	0	7501	18
M4	0	0	0	631	0	208	0	3	0	31	389	0	1262	10
M5	0	0	0	0	0	432	0	0	0	0	3820	0	4253	6
M6	0	0	0	0	0	118	0	0	0	4	5122	0	5244	9
Mowry Total	11569	88	54	7159	5	1291	0	4	75	3108	31849	1	55150	32
R1	6	28	17	0	203	3	0	121	0	551	21855	4	22771	30
R2	0	0	0	0	0	0	0	0	0	0	2282	0	2282	4
R3	0	0	0	0	0	0	0	0	0	39	11	0	50	4
R4	0	0	0	0	0	0	0	0	0	35	469	0	504	6
R5	0	0	0	0	0	0	0	0	0	2	0	0	2	1
R5S	0	0	0	0	0	0	0	0	0	12	0	0	12	1
RSF2U1	237	0	0	2	49	22	0	48	0	4084	620	14	5076	24
RSF2U2	599	0	0	0	148	54	0	22	0	2323	36	8	3190	28
RSF2U3	1	0	0	0	1	0	0	0	0	2	58	0	63	5
RSF2U4	25	14	14	0	23	0	0	3	0	23	32	0	120	12
Raven. Total	868	42	31	2	424	79	0	194	0	7071	25363	26	34070	44
Grand Total	42685	27654	16096	7360	10182	12400	1392	1860	3779	35452	109913	2483	253828	78

Table A2.4. Change in waterbird species richness and total sightings in fall (September 2023 - November 2023 compared to September 2022 - November 2022) in South San Francisco Bay, California. Percent change from the previous year is listed in parentheses; New indicates sites that were new colonizations (zero abundance in the previous period). Sites that were unoccupied by a guild in both periods are listed as Unused. RUDU counts are also included in counts of the DIVER guild and BOGU in counts of the GULL guild.

Area	DABBLER	DIVER	RUDU	EAREDGR	FISHEAT	GULL	BOGU	HERON	PHAL	MEDSHOR	SMSHOR	TERN	Total	Richness
A1	-358 (-70%)	-1199 (-24%)	-1139 (-34%)	+8 (+200%)	+20 (+11%)	+106 (+126%)	+7 (New)	+25 (+96%)	Unused	+3 (New)	+1 (New)	+37 (+529%)	-1357 (-23%)	+4 (+15%)
A10	-10 (-12%)	-584 (-40%)	-1257 (-91%)	-18 (-100%)	-34 (-14%)	-10 (-48%)	Unused	-37 (-70%)	Unused	+4 (+44%)	-60 (-80%)	-10 (-14%)	-759 (-38%)	+0 (+0%)
A11	+5 (+500%)	-665 (-20%)	-840 (-84%)	-7 (-100%)	-910 (-87%)	-41 (-59%)	Unused	-43 (-88%)	Unused	-41 (-84%)	-23 (-37%)	+216 (+460%)	-1509 (-33%)	+0 (+0%)
A12	Unused	Unused	Unused	Unused	Unused	-1381 (-31%)	Unused	Unused	Unused	-1 (-100%)	-3 (-100%)	+2 (New)	-1383 (-31%)	-1 (-17%)
A13	-10 (-100%)	-4 (-100%)	Unused	-13 (-100%)	+5 (New)	-1216 (-73%)	Unused	Unused	+1 (New)	-27 (-100%)	-785 (-59%)	Unused	-2049 (-67%)	-5 (-50%)
A14	-652 (-14%)	-992 (-49%)	+176 (+28%)	-3 (-60%)	-335 (-46%)	+269 (+196%)	-8 (-100%)	-42 (-78%)	Unused	-198 (-61%)	-370 (-96%)	+342 (+88%)	-1981 (-23%)	-3 (-8%)
A15	Unused	Unused	Unused	Unused	Unused	+39 (+26%)	Unused	-6 (-100%)	Unused	Unused	-762 (-58%)	+3 (New)	-726 (-49%)	+1 (+20%)
A16	-4577 (-59%)	-2491 (-87%)	-2533 (-88%)	+16 (+1600%)	-269 (-28%)	-80 (-11%)	+1 (New)	+88 (+66%)	Unused	-137 (-23%)	-1184 (-73%)	-5 (-19%)	-8637 (-59%)	+7 (+19%)
A17	-864 (-53%)	-19 (-68%)	-19 (-70%)	Unused	Unused	-43 (-93%)	Unused	+11 (+550%)	Unused	-2675 (-95%)	-186 (-99%)	Unused	-3775 (-80%)	-9 (-38%)
A19	-1626 (-42%)	-4 (-80%)	Unused	Unused	-1 (-100%)	+32 (+13%)	Unused	+2 (+100%)	Unused	+55 (+18%)	-34 (-85%)	Unused	-1576 (-35%)	-6 (-40%)
A22	Unused	Unused	Unused	Unused	Unused	-2 (-100%)	Unused	Unused	Unused	-3 (-100%)	-848 (-99%)	Unused	-853 (-99%)	-4 (-80%)
A23	Unused	Unused	Unused	Unused	Unused	-239 (-50%)	Unused	-1 (-100%)	Unused	-58 (-100%)	-926 (-100%)	Unused	-1224 (-84%)	-4 (-44%)
A2E	-49 (-62%)	+1368 (+2974%)	+1353 (+2941 %)	-1 (-6%)	-282 (-96%)	-70 (-70%)	Unused	-13 (-33%)	Unused	-42 (-78%)	-178 (-90%)	-2 (-50%)	+731 (+88%)	+4 (+20%)
A2W	-259 (-84%)	+534 (+19%)	-95 (-6%)	+7 (+54%)	-681 (-78%)	+167 (+668%)	Unused	+11 (+52%)	Unused	+20 (+667%)	-32 (-80%)	-285 (-98%)	-518 (-12%)	+4 (+14%)
A3N	-237 (-100%)	-26 (-100%)	-26 (-100%)	Unused	Unused	-120 (-98%)	Unused	-2 (-50%)	Unused	-538 (-33%)	-1685 (-83%)	+0 (+0%)	-2608 (-65%)	-7 (-39%)
A3W	-8 (-2%)	+1727 (+51%)	+1719 (+50%)	+3 (+33%)	-639 (-92%)	-43 (-39%)	-1 (-100%)	-20 (-42%)	Unused	-449 (-99%)	-260 (-82%)	-13 (-87%)	+306 (+6%)	-7 (-21%)
A5	-905 (-48%)	-6358 (-75%)	-2164 (-75%)	-66 (-84%)	-300 (-41%)	-152 (-74%)	Unused	-53 (-77%)	Unused	+26 (+113%)	-114 (-39%)	-59 (-76%)	-7983 (-68%)	+6 (+16%)
A6S	+62 (+72%)	-4 (-80%)	-4 (-80%)	Unused	-1 (-100%)	+0 (+0%)	Unused	+13 (+186%)	Unused	-562 (-100%)	-22 (-100%)	Unused	-514 (-75%)	-4 (-31%)
A7	+4571 (+705%)	+167 (+9%)	+130 (+82%)	+9 (New)	-746 (-71%)	-162 (-84%)	Unused	-47 (-82%)	Unused	-3 (-3%)	+84 (+51%)	-108 (-92%)	+3766 (+88%)	+8 (+28%)
A8	+26 (+6%)	-9278 (-94%)	-715 (-75%)	+2 (New)	+353 (+436%)	+269 (+527%)	Unused	+13 (+108%)	Unused	+19 (+35%)	+100 (New)	-322 (-87%)	-8818 (-81%)	+11 (+39%)

Area	DABBLER	DIVER	RUDU	EAREDGR	FISHEAT	GULL	BOGU	HERON	PHAL	MEDSHOR	SMSHOR	TERN	Total	Richness
A8S	+63 (+45%)	-1112 (-84%)	-822 (-86%)	+3 (+60%)	+43 (+55%)	-30 (-49%)	Unused	-51 (-70%)	Unused	+36 (+120%)	+14 (New)	-317 (-83%)	-1351 (-65%)	+0 (+0%)
A8W	+152 (+304%)	+2 (+67%)	+2 (+67%)	-4 (-100%)	+42 (+81%)	+12 (+150%)	+2 (New)	-4 (-44%)	Unused	+20 (+250%)	+3 (New)	-53 (-26%)	+170 (+51%)	+3 (+15%)
A9	-2754 (-88%)	-73 (-58%)	-49 (-73%)	+4 (New)	+32 (+57%)	-84 (-86%)	Unused	-130 (-91%)	+669 (+7433%)	-2029 (-41%)	-30994 (-95%)	-1 (-33%)	-35360 (-86%)	-8 (-24%)
AB1	-656 (-70%)	+1287 (+292%)	+1311 (+321%)	Unused	-24 (-27%)	-7 (-50%)	Unused	-6 (-35%)	Unused	+22 (+733%)	-116 (-92%)	-8 (-89%)	+492 (+30%)	-2 (-9%)
AB2	+1627 (+105%)	-1577 (-78%)	-1119 (-72%)	+0 (+0%)	-16 (-11%)	+161 (+183%)	Unused	+19 (+59%)	Unused	+332 (+593%)	-143 (-80%)	Unused	+404 (+10%)	+0 (+0%)
Alviso Total	-6459 (-23%)	-19301 (-43%)	-6091 (-29%)	-60 (-34%)	-3743 (-51%)	-2625 (-29%)	+1 (+11%)	-273 (-32%)	+670 (+7444%)	-6226 (-52%)	-38523 (-90%)	-583 (-29%)	-77112 (-52%)	+5 (+8%)
N1A	+289 (+1204%)	+0 (+0%)	-7 (-100%)	Unused	+2 (+1%)	-56 (-57%)	Unused	+21 (+105%)	Unused	+311 (New)	+80 (New)	-38 (-26%)	+606 (+126%)	+7 (+41%)
N2A	+897 (+4721%)	-478 (-71%)	-142 (-80%)	-7 (-64%)	-28 (-8%)	+183 (+265%)	Unused	+7 (+140%)	Unused	+342 (+17100%)	+53 (+1060%)	+27 (New)	+996 (+89%)	+9 (+47%)
N3A	-69 (-58%)	+169 (+2414%)	Unused	Unused	+413 (+48%)	+136 (+35%)	+132 (New)	+162 (+1246%)	Unused	+261 (+164%)	+1017 (+433%)	-203 (-91%)	+1886 (+94%)	-3 (-12%)
N4	-2 (-100%)	-1 (-100%)	Unused	-67 (-100%)	+27 (+338%)	+2 (New)	Unused	-5 (-71%)	-12 (-100%)	-295 (-23%)	-348 (-58%)	+3 (New)	-698 (-36%)	-3 (-17%)
N4AA	+147 (+588%)	Unused	Unused	Unused	-201 (-30%)	-14 (-8%)	+39 (+488%)	+7 (+23%)	Unused	+10 (+12%)	+540 (+100%)	-403 (-83%)	+86 (+4%)	-4 (-13%)
N4AB	-2618 (-71%)	+73 (+332%)	-20 (-100%)	-19 (-100%)	+1976 (+457%)	+170 (+170%)	+47 (New)	+127 (+605%)	Unused	+42 (+4200%)	+59 (New)	+37 (+1850%)	-153 (-4%)	-1 (-4%)
N4B	+32 (New)	+1 (New)	Unused	Unused	-161 (-99%)	-866 (-100%)	Unused	-21 (-41%)	Unused	+542 (+10840%)	+875 (+2188%)	Unused	+402 (+36%)	+8 (+80%)
N5	Unused	-9 (-69%)	Unused	Unused	-55 (-57%)	-9 (-82%)	Unused	+3 (New)	Unused	+94 (+495%)	-22 (-32%)	+1 (New)	+3 (+1%)	+4 (+80%)
N6	-43 (-100%)	Unused	Unused	Unused	-14 (-74%)	-2 (-100%)	Unused	+9 (+900%)	Unused	-1 (-25%)	+247 (+51%)	+3 (New)	+199 (+36%)	+2 (+18%)
N7	-6 (-32%)	-2 (-100%)	-2 (-100%)	Unused	-78 (-40%)	+174 (+305%)	Unused	+3 (+75%)	Unused	+73 (+7300%)	+530 (+815%)	+151 (New)	+845 (+248%)	+5 (+45%)
N8	Unused	Unused	Unused	Unused	-111 (-89%)	-250 (-97%)	Unused	+4 (+44%)	Unused	-26 (-93%)	+161 (+519%)	+1 (New)	-221 (-49%)	-3 (-19%)
N9	-6 (-100%)	Unused	Unused	Unused	+257 (+74%)	-16 (-12%)	Unused	-6 (-40%)	Unused	+8 (+24%)	+896 (+219%)	-1 (-100%)	+1131 (+119%)	+2 (+12%)
C. Hills Total	-1379 (-35%)	-247 (-34%)	-171 (-83%)	-93 (-96%)	+2027 (+59%)	-548 (-25%)	+218 (+2725%)	+311 (+177%)	-12 (-100%)	+1361 (+85%)	+4088 (+165%)	-422 (-49%)	+5082 (+33%)	-9 (-17%)
N1	-834 (-41%)	-727 (-97%)	-43 (-90%)	+4 (+12%)	+0 (+0%)	+1170 (+7312%)	+903 (New)	-1 (-50%)	+5 (New)	-392 (-46%)	-301 (-38%)	Unused	-1076 (-24%)	+2 (+10%)
N2	-2322 (-100%)	-36 (-78%)	-16 (-89%)	-32 (-67%)	Unused	-314 (-100%)	Unused	+3 (+150%)	Unused	-28 (-74%)	-93 (-85%)	Unused	-2822 (-98%)	-6 (-40%)
N3	-3877 (-99%)	-49 (-80%)	-56 (-97%)	-495 (-99%)	+15 (+167%)	-31 (-32%)	Unused	+15 (+1500%)	Unused	-469 (-26%)	-2130 (-88%)	-2 (-100%)	-7023 (-79%)	+0 (+0%)
NPP1	+604 (+397%)	+106 (New)	Unused	+7 (+233%)	+1 (New)	+177 (+1609%)	+173 (New)	+2 (New)	+2 (New)	-239 (-37%)	-13372 (-84%)	Unused	-12712 (-76%)	+9 (+69%)
Dumb. Total	-6429 (-76%)	-706 (-82%)	-115 (-93%)	-516 (-88%)	+16 (+133%)	+1002 (+229%)	+1076 (New)	+19 (+380%)	+7 (New)	-1128 (-33%)	-15896 (-83%)	-2 (-100%)	-23633 (-72%)	+3 (+11%)

Area	DABBLER	DIVER	RUDU	EAREDGR	FISHEAT	GULL	BOGU	HERON	PHAL	MEDSHOR	SMSHOR	TERN	Total	Richness
CP3C	-90 (-95%)	-15 (-100%)	-5 (-100%)	-10 (-100%)	+12 (+1200%)	+205 (+122%)	+26 (New)	+9 (+900%)	-5 (-100%)	+171 (+178%)	+360 (+32%)	+16 (New)	+653 (+43%)	+5 (+29%)
E1	-19 (-95%)	-84 (-91%)	-5 (-50%)	-2 (-100%)	-424 (-63%)	+57 (+70%)	Unused	-51 (-80%)	Unused	+55 (+2750%)	-316 (-100%)	+21 (+117%)	-763 (-60%)	-10 (-37%)
E10	-31 (-56%)	+36 (+450%)	+0 (+0%)	Unused	+119 (+744%)	+50 (+2500%)	+49 (New)	+88 (+352%)	Unused	-7 (-2%)	+101 (+594%)	+12 (New)	+368 (+86%)	+4 (+22%)
E11	-3 (-20%)	+3 (New)	Unused	Unused	Unused	-250 (-100%)	Unused	-5 (-45%)	Unused	-2807 (-80%)	-845 (-82%)	+2 (New)	-3905 (-81%)	-2 (-12%)
E12	+261 (+8700%)	+6 (New)	Unused	+1 (New)	+44 (+122%)	-55 (-30%)	-1 (-100%)	+58 (+252%)	+410 (New)	+565 (+59%)	-7680 (-71%)	+47 (+247%)	-6343 (-53%)	+7 (+28%)
E13	+74 (+132%)	+8 (New)	Unused	+2 (New)	+1 (New)	+71 (New)	Unused	+0 (+0%)	+1121 (New)	-622 (-93%)	-5514 (-50%)	Unused	-4859 (-41%)	+9 (+60%)
E14	Unused	Unused	Unused	Unused	Unused	Unused	Unused	+6 (New)	+0 (+0%)	+104 (+945%)	+4584 (+90%)	Unused	+4694 (+92%)	+6 (+60%)
E1C	+20 (+25%)	Unused	Unused	Unused	Unused	-5 (-100%)	Unused	-2 (-67%)	Unused	+496 (+417%)	+423 (+61%)	Unused	+932 (+103%)	+1 (+8%)
E2	-73 (-57%)	-7 (-78%)	-7 (-78%)	-8 (-100%)	-33 (-25%)	-41 (-39%)	Unused	+143 (+2043%)	-1013 (-96%)	+63 (+30%)	+5233 (+1192%)	+18 (+67%)	+4282 (+202%)	+2 (+8%)
E2C	-6 (-14%)	Unused	Unused	Unused	Unused	+1 (New)	Unused	+4 (+100%)	Unused	-9 (-5%)	+1296 (+3812%)	+1 (New)	+1287 (+499%)	+7 (+58%)
E4	+84 (+175%)	Unused	Unused	Unused	-13 (-46%)	-90 (-67%)	Unused	+54 (+5400%)	-2611 (-100%)	+160 (+34%)	-3912 (-80%)	-13 (-100%)	-6341 (-78%)	+4 (+24%)
E4C	-1059 (-99%)	Unused	Unused	Unused	Unused	-101 (-42%)	Unused	Unused	Unused	-499 (-37%)	-7154 (-70%)	Unused	-8813 (-69%)	+0 (+0%)
E5	+664 (+157%)	Unused	Unused	Unused	-65 (-100%)	+201 (+773%)	Unused	Unused	+1047 (New)	+531 (+76%)	-348 (-78%)	+28 (New)	+2058 (+124%)	+4 (+36%)
E5C	-136 (-36%)	Unused	Unused	Unused	Unused	-187 (-99%)	Unused	Unused	-147 (-99%)	+366 (+212%)	+234 (+56%)	+7 (New)	+137 (+11%)	+5 (+42%)
E6	-2174 (-96%)	+2 (New)	Unused	-73 (-97%)	Unused	-587 (-92%)	Unused	Unused	+100 (+44%)	-1564 (-99%)	-1347 (-97%)	Unused	-5622 (-91%)	-6 (-38%)
E6A	-1022 (-62%)	-864 (-55%)	-905 (-63%)	-3 (-50%)	+25 (+250%)	-94 (-52%)	Unused	-7 (-33%)	Unused	+29 (+12%)	-881 (-51%)	Unused	-2818 (-52%)	-5 (-14%)
E6B	-14 (-5%)	+247 (+882%)	+207 (+10350 %)	-13 (-100%)	Unused	+1 (+100%)	Unused	-3 (-75%)	-118 (-100%)	+162 (+20%)	-5160 (-63%)	Unused	-4898 (-52%)	-5 (-23%)
E6C	+168 (New)	Unused	Unused	Unused	Unused	Unused	Unused	+1 (New)	Unused	Unused	+155 (+194%)	Unused	+324 (+405%)	+4 (+200%)
E7	-24 (-38%)	+4 (New)	+4 (New)	-2 (-100%)	-311 (-84%)	-42 (-84%)	+5 (New)	+31 (+388%)	+14 (+48%)	+36 (+26%)	+31 (+28%)	-279 (-43%)	-542 (-38%)	-5 (-18%)
E8	-258 (-51%)	-92 (-50%)	-66 (-97%)	-3 (-100%)	Unused	+1 (+100%)	Unused	+1 (+100%)	-17 (-41%)	+1698 (+305%)	-1649 (-59%)	Unused	-297 (-7%)	+4 (+20%)
E8AE	+2 (New)	Unused	Unused	Unused	Unused	Unused	Unused	+1 (+50%)	Unused	+75 (+28%)	-1476 (-95%)	Unused	-1398 (-77%)	+2 (+29%)
E8AW	+268 (New)	Unused	Unused	Unused	+1 (+100%)	+3 (New)	Unused	+2 (+25%)	Unused	+44 (+4%)	-4616 (-100%)	+1 (New)	-4297 (-74%)	+1 (+9%)
E8XN	+1 (New)	Unused	Unused	Unused	+1 (New)	Unused	Unused	+3 (+100%)	Unused	-1 (-100%)	Unused	Unused	+4 (+100%)	-1 (-25%)
E8XS	Unused	Unused	Unused	Unused	Unused	Unused	Unused	+0 (+0%)	Unused	-1 (-50%)	-61 (-100%)	Unused	-62 (-94%)	+1 (+33%)

Area	DABBLER	DIVER	RUDU	EAREDGR	FISHEAT	GULL	BOGU	HERON	PHAL	MEDSHOR	SMSHOR	TERN	Total	Richness
E9	+2 (New)	Unused	Unused	Unused	-3 (-75%)	+2 (New)	Unused	+31 (+310%)	Unused	-5110 (-76%)	-21643 (-99%)	Unused	-26721 (-94%)	+0 (+0%)
Eden Total	-3365 (-47%)	-756 (-40%)	-777 (-50%)	-111 (-93%)	-646 (-49%)	-860 (-38%)	+79 (+7900%)	+364 (+179%)	-1219 (-29%)	-6065 (-30%)	-50185 (-57%)	-139 (-19%)	-62940 (-50%)	-3 (-5%)
M1	+1182 (+425%)	-2 (-10%)	-2 (-10%)	+2179 (+2985%)	-44 (-94%)	+301 (+4300%)	Unused	-1 (-100%)	-19 (-100%)	+689 (+50%)	-952 (-9%)	-84 (-100%)	+3249 (+25%)	+5 (+42%)
M2	+8541 (+14002%)	-275 (-80%)	-297 (-89%)	+668 (+151%)	-43 (-96%)	-98 (-40%)	Unused	+0 (+0%)	-416 (-85%)	-1529 (-73%)	-2243 (-18%)	+1 (New)	+4606 (+28%)	-1 (-5%)
M3	+1075 (+249%)	Unused	Unused	-651 (-17%)	-3 (-100%)	-289 (-78%)	Unused	Unused	Unused	+101 (+29%)	+1298 (+130%)	Unused	+1531 (+26%)	+10 (+125%)
M4	-51 (-100%)	-12 (-100%)	-12 (-100%)	-979 (-61%)	Unused	-419 (-67%)	-8 (-100%)	+3 (New)	-11 (-100%)	-114 (-79%)	+104 (+36%)	Unused	-1479 (-54%)	-1 (-9%)
M5	-79 (-100%)	Unused	Unused	-185 (-100%)	Unused	+354 (+454%)	Unused	Unused	Unused	-102 (-100%)	+3690 (+2838%)	Unused	+3679 (+641%)	-3 (-33%)
M6	Unused	Unused	Unused	-14 (-100%)	Unused	+92 (+354%)	-1 (-100%)	Unused	Unused	-124 (-97%)	+4992 (+3840%)	Unused	+4946 (+1660 %)	+1 (+12%)
Mowry Total	+10668 (+1184%)	-289 (-77%)	-311 (-85%)	+1018 (+17%)	-90 (-95%)	-59 (-4%)	-9 (-100%)	+2 (+100%)	-446 (-86%)	-1079 (-26%)	+6889 (+28%)	-83 (-99%)	+16532 (+43%)	+6 (+23%)
R1	-5 (-45%)	+25 (+833%)	+14 (+467%)	-4 (-100%)	+51 (+34%)	-886 (-100%)	Unused	+1 (+1%)	-162 (-100%)	-4264 (-89%)	-10729 (-33%)	-1 (-20%)	-15974 (-41%)	-3 (-9%)
R2	Unused	Unused	Unused	Unused	Unused	Unused	Unused	Unused	Unused	-1 (-100%)	+2278 (+56950%)	Unused	+2277 (+45540 %)	+2 (+100%)
R3	Unused	Unused	Unused	Unused	Unused	Unused	Unused	Unused	Unused	-123 (-76%)	-84 (-88%)	Unused	-207 (-81%)	+1 (+33%)
R4	-1 (-100%)	Unused	Unused	Unused	Unused	Unused	Unused	Unused	Unused	-297 (-89%)	+101 (+27%)	Unused	-197 (-28%)	-3 (-33%)
R5	Unused	Unused	Unused	Unused	Unused	Unused	Unused	Unused	Unused	-6 (-75%)	Unused	Unused	-6 (-75%)	+0 (+0%)
R5S	Unused	Unused	Unused	Unused	Unused	Unused	Unused	Unused	Unused	+12 (New)	-1 (-100%)	Unused	+11 (+1100%)	+0 (+0%)
RSF2U1	-31 (-12%)	Unused	Unused	+2 (New)	+32 (+188%)	+1 (+5%)	Unused	+18 (+60%)	Unused	+2324 (+132%)	+432 (+230%)	+9 (+180%)	+2787 (+122%)	+5 (+26%)
RSF2U2	-4967 (-89%)	Unused	Unused	Unused	+105 (+244%)	-55 (-50%)	Unused	+0 (+0%)	Unused	-4042 (-64%)	-15 (-29%)	-1 (-11%)	-8975 (-74%)	+9 (+47%)
RSF2U3	+1 (New)	Unused	Unused	Unused	+1 (New)	Unused	Unused	Unused	Unused	+0 (+0%)	+52 (+867%)	Unused	+55 (+688%)	+3 (+150%)
RSF2U4	-56 (-69%)	+14 (New)	+14 (New)	Unused	+22 (+2200%)	Unused	Unused	-6 (-67%)	Unused	-151 (-87%)	-891 (-97%)	Unused	-1068 (-90%)	-5 (-29%)
Ravens. Total	-5059 (-85%)	+39 (+1300%)	+28 (+933%)	-2 (-50%)	+211 (+99%)	-940 (-92%)	Unused	+13 (+7%)	-162 (-100%)	-6548 (-48%)	-8857 (-26%)	+7 (+37%)	-21297 (-38%)	+4 (+10%)
Grand Total	-12023 (-22%)	-21260 (-43%)	-7437 (-32%)	+236 (+3%)	-2225 (-18%)	-4030 (-25%)	+1365 (+5056%)	+436 (+31%)	-1162 (-24%)	-19685 (-36%)	-102484 (-48%)	-1222 (-33%)	-163368 (-39%)	+4 (+5%)

Table A2.5. Waterbird species richness and total sightings in winter (December 2023 - February 2024) in South San Francisco Bay, California. RUDU counts are also included in counts of the DIVER guild and BOGU in counts of the GULL guild.

Area	DABB-LER	DIVER	RUDU	EARED GR	FISH-EAT	GULL	BOGU	HERON	PHAL	MED SHOR	SM SHOR	TERN	Total	Rich-ness
A1	1696	6256	2724	19	121	53	0	20	0	1	0	9	8186	25
A10	388	2920	2214	51	90	9	0	12	0	2	15	0	3488	33
A11	46	599	124	7	48	11	0	4	0	4	12	0	737	31
A12	1	0	0	0	0	768	0	0	0	0	0	0	769	7
A13	3	192	0	0	0	518	0	0	0	84	1103	0	1906	14
A14	8303	1855	862	168	327	57	0	22	0	187	1	1	10922	36
A15	0	0	0	0	0	545	0	0	0	1	284	0	836	11
A16	8570	1015	699	17	91	369	0	22	0	172	8	6	10298	43
A17	1692	412	62	0	2	400	0	5	0	368	59	0	2938	29
A19	1118	48	41	0	0	1572	0	2	0	396	6	0	3152	20
A22	80	23	0	0	0	1332	0	2	0	1183	963	0	3600	20
A23	0	0	0	0	0	2231	0	0	0	1759	200	0	4204	14
A2E	69	5477	5060	20	24	1023	134	12	0	0	18	28	6673	26
A2W	73	4863	1867	9	108	74	0	33	0	7	99	21	5314	29
A3N	75	271	195	0	12	2	0	3	0	1	106	0	470	13
A3W	7909	8781	7651	129	464	171	121	42	0	5	21	9	17531	35
A5	1108	2398	1093	81	233	1405	432	19	0	5	90	5	5352	35
A6S	367	26	26	0	0	0	0	3	0	17	0	0	413	10
A7	1543	720	256	18	116	1082	0	13	0	6	83	0	3585	30
A8	83	577	517	475	75	168	0	14	0	28	54	2	1485	30
A8S	77	966	531	282	92	455	3	13	0	34	77	0	1996	38
A8W	488	16	11	1	32	221	97	2	0	0	0	2	762	17
A9	3796	2172	2094	0	232	57	0	9	0	2987	1881	4	11138	31
AB1	490	2085	2011	0	3	12	0	43	0	3863	148	1	6645	27
AB2	4222	845	653	3	34	120	0	26	0	671	286	8	6215	35
Alviso Total	42197	42517	28691	1280	2104	12655	787	321	0	11781	5514	96	118615	66
N1A	288	1133	36	0	220	46	0	37	0	436	30	0	2204	34
N2A	7	6080	3339	34	183	454	0	3	0	137	0	0	6907	24
N3A	2060	829	124	0	137	912	0	5	0	188	559	8	4704	29
N4	0	202	150	0	18	7	0	11	0	2377	50	11	2680	19
N4AA	799	1031	85	2	67	43	3	13	0	126	553	417	3055	30
N4AB	4166	2112	1191	14	163	613	0	9	0	2	1	3	7087	29

Area	DABB-LER	DIVER	RUDU	EARED GR	FISH-EAT	GULL	BOGU	HERON	PHAL	MED SHOR	SM SHOR	TERN	Total	Rich-ness
N4B	512	189	20	1	0	0	0	9	0	356	345	1	1413	19
N5	92	64	55	0	112	2	0	21	0	5	23	24	343	17
N6	11	118	15	0	60	173	0	5	0	1	167	3	538	19
N7	73	53	0	1	25	2	0	19	0	0	77	0	261	15
N8	24	88	11	0	61	31	0	12	0	7	335	0	566	19
N9	155	444	235	0	72	371	2	17	0	153	437	5	1654	25
C. Hills Total	8187	12343	5261	52	1118	2654	5	161	0	3788	2577	472	31412	51
N1	2424	730	54	95	5	700	700	0	0	285	253	2	4501	21
N2	1	26	0	0	3	21	0	2	0	9	10	0	104	12
N3	0	55	0	0	13	6	0	6	0	123	578	11	792	14
NPP1	1844	66	0	136	1	330	82	1	0	1204	4852	0	8461	23
Dumb. Total	4269	877	54	231	22	1057	782	9	0	1621	5693	13	13858	32
CP3C	364	896	768	1	16	370	0	9	0	989	1509	85	4321	30
E1	18	2397	1186	0	39	13	0	5	0	477	79	9	3043	27
E10	377	3069	2554	0	11	5	0	13	0	91	1	20	3587	23
E11	151	427	30	0	38	0	0	6	0	44	0	2	675	15
E12	2618	473	37	1	14	27	0	36	0	1125	1643	99	6036	37
E13	657	31	11	0	0	4	0	5	0	1270	4823	1	6791	26
E14	43	0	0	0	0	1	0	9	0	11	3582	1	3654	15
E1C	67	126	2	0	0	0	0	2	0	130	54	0	379	14
E2	421	2186	1695	1	91	22	11	23	0	231	451	4	3436	41
E2C	321	3	0	0	0	2	0	5	0	166	106	1	604	15
E4	873	41	0	0	2	4	0	25	0	1343	463	6	2761	23
E4C	117	309	47	0	0	4	0	1	0	1059	5061	0	6556	16
E5	645	54	44	3	0	0	0	0	0	142	20	0	865	12
E5C	11	88	0	0	0	0	0	1	0	22	23	0	147	10
E6	136	249	156	5	0	21	0	0	0	59	1296	0	1768	20
E6A	1747	3928	3647	5	23	16	0	14	0	389	4159	2	10286	36
E6B	359	1701	1658	0	1	31	0	6	0	255	4455	3	6811	28
E6C	689	80	23	0	0	44	44	1	0	1	6	0	821	9
E7	181	428	0	0	12	10	2	5	0	5	41	110	792	20
E8	952	237	152	0	0	0	0	2	0	755	584	0	2530	22
E8AE	35	0	0	0	0	1	0	3	0	91	480	0	610	11
E8AW	108	15	0	0	0	1	0	2	0	20	0	0	146	9

Area	DABB-LER	DIVER	RUDU	EARED GR	FISH-EAT	GULL	BOGU	HERON	PHAL	MED SHOR	SM SHOR	TERN	Total	Rich-ness
E8XN	17	476	158	0	6	0	0	6	0	0	0	1	506	14
E8XS	27	2	0	0	0	0	0	2	0	0	0	0	31	5
E9	2803	97	0	0	9	3	0	10	0	20	0	0	2942	18
Eden Total	13737	17313	12168	16	262	579	57	191	0	8695	28836	344	70098	59
M1	1941	261	241	1319	2	295	0	1	0	812	2641	0	7313	23
M2	7399	565	225	2111	0	543	0	0	0	943	519	1	12088	23
M3	2008	446	51	3583	0	145	0	1	0	1618	7620	0	15425	24
M4	1596	342	3	3365	0	945	0	0	0	33	207	0	6498	14
M5	243	38	0	410	0	692	0	0	0	87	2910	0	4380	14
M6	5	827	0	1	0	49	0	0	0	12	875	0	1769	15
Mowry Total	13192	2479	520	10789	2	2669	0	2	0	3505	14772	1	47473	34
R1	130	411	223	1	3	19	0	13	0	919	17473	24	19003	33
R2	13	175	0	0	0	4	0	0	0	159	3575	7	3935	15
R3	0	5	0	0	0	0	0	7	0	50	87	0	217	11
R4	0	0	0	0	1	0	0	3	0	407	2622	61	3117	11
R5	8	1	0	0	0	0	0	1	0	61	430	0	602	14
R5S	8	8	0	0	0	0	0	1	0	17	0	0	42	6
RSF2U1	714	400	29	0	1	36	0	31	0	5525	796	14	7521	34
RSF2U2	245	69	0	0	0	26	0	6	0	2840	732	1	3921	25
RSF2U3	0	70	0	0	0	6	0	0	0	53	300	0	430	12
RSF2U4	3	988	882	0	0	0	0	2	0	0	0	0	996	8
Ravens. Total	1121	2127	1134	1	5	91	0	64	0	10031	26015	107	39784	45
Grand Total	82703	77656	47828	12369	3513	19705	1631	748	0	39421	83407	1033	321240	75

Table A2.6. Change in waterbird species richness and total sightings in winter (December 2023 - February 2024 compared to December 2022 - February 2023) in South San Francisco Bay, California. Percent change from the previous year is listed in parentheses; New indicates sites that were new colonizations (zero abundance in the previous period). Sites that were unoccupied by a guild in both periods are listed as Unused. RUDU counts are also included in counts of the DIVER guild and BOGU in counts of the GULL guild.

Area	DABBLER	DIVER	RUDU	EAREDGR	FISHEAT	GULL	BOGU	HERON	PHAL	MEDSHOR	SMSHOR	TERN	Total	Rich-ness
A1	-1028 (-38%)	+1328 (+27%)	+978 (+56%)	+9 (+90%)	+51 (+73%)	+6 (+13%)	Unused	+16 (+400%)	Unused	+1 (New)	Unused	+8 (+800%)	+398 (+5%)	+2 (+9%)
A10	+324 (+506%)	+83 (+3%)	+64 (+3%)	+43 (+538%)	-1 (-1%)	-178 (-95%)	Unused	-1 (-8%)	Unused	-1 (-33%)	-57 (-79%)	-7 (-100%)	+206 (+6%)	+2 (+6%)
A11	+20 (+77%)	-4725 (-89%)	-943 (-88%)	-2 (-22%)	-92 (-66%)	-81 (-88%)	Unused	-3 (-43%)	Unused	+1 (+33%)	+11 (+1100%)	-3 (-100%)	-4868 (-87%)	+6 (+24%)
A12	+1 (New)	Unused	Unused	Unused	Unused	+224 (+41%)	Unused	Unused	Unused	-46 (-100%)	-39 (-100%)	Unused	+140 (+22%)	-3 (-30%)
A13	-8 (-73%)	-100 (-34%)	Unused	-3 (-100%)	Unused	-14 (-3%)	Unused	Unused	Unused	+57 (+211%)	-2188 (-66%)	Unused	-2250 (-54%)	-1 (-7%)
A14	+743 (+10%)	-8291 (-82%)	-303 (-26%)	+140 (+500%)	+221 (+208%)	-76 (-57%)	Unused	+10 (+83%)	Unused	+180 (+2571%)	-16 (-94%)	+1 (New)	-7089 (-39%)	+11 (+44%)
A15	Unused	-18 (-100%)	Unused	-3 (-100%)	Unused	-1215 (-69%)	Unused	-1 (-100%)	Unused	-3 (-75%)	-1039 (-79%)	Unused	-2275 (-73%)	-4 (-27%)
A16	-141 (-2%)	-1432 (-59%)	-1522 (-69%)	-19 (-53%)	-159 (-64%)	+67 (+22%)	-10 (-100%)	-14 (-39%)	Unused	-31 (-15%)	-1036 (-99%)	-44 (-88%)	-2791 (-21%)	+1 (+2%)
A17	+677 (+67%)	+91 (+28%)	+5 (+9%)	Unused	+2 (New)	+350 (+700%)	Unused	+5 (New)	Unused	+367 (+36700%)	+59 (New)	Unused	+1551 (+112%)	+17 (+142%)
A19	+270 (+32%)	+48 (New)	+41 (New)	Unused	Unused	+883 (+128%)	Unused	+2 (New)	Unused	-233 (-37%)	+6 (New)	Unused	+982 (+45%)	+13 (+186%)
A22	+68 (+567%)	-47 (-67%)	-13 (-100%)	-1 (-100%)	Unused	-35 (-3%)	-1 (-100%)	+2 (New)	Unused	-869 (-42%)	-730 (-43%)	Unused	-1602 (-31%)	-3 (-13%)
A23	Unused	Unused	Unused	Unused	Unused	+10 (+0%)	Unused	-2 (-100%)	Unused	+1381 (+365%)	-278 (-58%)	Unused	+1121 (+36%)	+1 (+8%)
A2E	-3542 (-98%)	+1284 (+31%)	+2107 (+71%)	-24 (-55%)	-76 (-76%)	+733 (+253%)	+98 (+272%)	-32 (-73%)	Unused	-2 (-100%)	+18 (New)	-57 (-67%)	-1698 (-20%)	+0 (+0%)
A2W	-988 (-93%)	-1954 (-29%)	-70 (-4%)	-6 (-40%)	+16 (+17%)	+70 (+1750%)	Unused	+27 (+450%)	Unused	+4 (+133%)	+94 (+1880%)	+21 (New)	-2697 (-34%)	+5 (+21%)
A3N	+50 (+200%)	+144 (+113%)	+101 (+107%)	-3 (-100%)	+12 (New)	-60 (-97%)	Unused	-4 (-57%)	Unused	-217 (-100%)	-43 (-29%)	Unused	-123 (-21%)	-4 (-24%)
A3W	+6688 (+548%)	-3565 (-29%)	-1032 (-12%)	+14 (+12%)	+266 (+134%)	+95 (+125%)	+121 (New)	+24 (+133%)	Unused	+2 (+67%)	-25 (-54%)	-17 (-65%)	+3482 (+25%)	+6 (+21%)
A5	+760 (+218%)	-3529 (-60%)	-1470 (-57%)	-8 (-9%)	+189 (+430%)	-368 (-21%)	+432 (New)	+2 (+12%)	Unused	-142 (-97%)	+38 (+73%)	+2 (+67%)	-3054 (-36%)	+7 (+25%)
A6S	-457 (-55%)	-26 (-50%)	-22 (-46%)	Unused	Unused	-4 (-100%)	Unused	-5 (-62%)	Unused	-239 (-93%)	-485 (-100%)	Unused	-1216 (-75%)	-7 (-41%)
A7	+1479 (+2311%)	-1775 (-71%)	-376 (-59%)	-14 (-44%)	+50 (+76%)	-22 (-2%)	Unused	+2 (+18%)	Unused	-14 (-70%)	+48 (+137%)	-6 (-100%)	-250 (-7%)	-5 (-14%)
A8	-5 (-6%)	-1917 (-77%)	-878 (-63%)	+468 (+6686%)	+33 (+79%)	+117 (+229%)	Unused	+13 (+1300%)	Unused	+24 (+600%)	+53 (+5300%)	+2 (New)	-1203 (-45%)	+7 (+30%)

Area	DABBLER	DIVER	RUDU	EAREDGR	FISHEAT	GULL	BOGU	HERON	PHAL	MEDSHOR	SMSHOR	TERN	Total	Rich-ness
A8S	-47 (-38%)	-76 (-7%)	-303 (-36%)	+205 (+266%)	+74 (+411%)	+328 (+258%)	+3 (New)	+1 (+8%)	Unused	+30 (+750%)	+67 (+670%)	Unused	+582 (+41%)	+19 (+100%)
A8W	+472 (+2950%)	-96 (-86%)	-60 (-85%)	-19 (-95%)	+15 (+88%)	-19 (-8%)	+97 (New)	+0 (+0%)	Unused	-4 (-100%)	-45 (-100%)	+2 (New)	+306 (+67%)	+0 (+0%)
A9	-1915 (-34%)	-477 (-18%)	-524 (-20%)	Unused	+183 (+373%)	-64 (-53%)	-1 (-100%)	-14 (-61%)	Unused	-14 (-0%)	-26655 (-93%)	-74 (-95%)	-29039 (-72%)	-8 (-21%)
AB1	-4407 (-90%)	+1545 (+286%)	+1878 (+1412%)	-2 (-100%)	-37 (-92%)	-18 (-60%)	-3 (-100%)	-86 (-67%)	Unused	+3470 (+883%)	-1257 (-89%)	-1 (-50%)	-793 (-11%)	-9 (-25%)
AB2	+2647 (+168%)	-1729 (-67%)	-1651 (-72%)	-13 (-81%)	-100 (-75%)	-93 (-44%)	Unused	-14 (-35%)	Unused	-1136 (-63%)	-2019 (-88%)	+6 (+300%)	-2451 (-28%)	-3 (-8%)
Alviso Totals	+1661 (+4%)	-25234 (-37%)	-3993 (-12%)	+762 (+147%)	+647 (+44%)	+636 (+5%)	+736 (+1443%)	-72 (-18%)	Unused	+2566 (+28%)	-35518 (-87%)	-167 (-63%)	-54631 (-32%)	+5 (+8%)
N1A	+261 (+967%)	+115 (+11%)	-227 (-86%)	-1 (-100%)	+157 (+249%)	+8 (+21%)	Unused	+24 (+185%)	Unused	+434 (+21700%)	+30 (New)	-12 (-100%)	+1028 (+87%)	+11 (+48%)
N2A	-6 (-46%)	+3155 (+108%)	+2485 (+291%)	+30 (+750%)	+96 (+110%)	-346 (-43%)	Unused	+0 (+0%)	Unused	+137 (New)	-1 (-100%)	Unused	+3072 (+80%)	+2 (+9%)
N3A	-1823 (-47%)	-3588 (-81%)	-3166 (-96%)	-7 (-100%)	+64 (+88%)	-218 (-19%)	Unused	+2 (+67%)	Unused	+186 (+9300%)	-91 (-14%)	+2 (+33%)	-5472 (-54%)	+1 (+4%)
N4	-4 (-100%)	+138 (+216%)	+146 (+3650%)	Unused	+4 (+29%)	+3 (+75%)	Unused	-11 (-50%)	Unused	-43 (-2%)	-41 (-45%)	+11 (New)	+56 (+2%)	+0 (+0%)
N4AA	-4824 (-86%)	+577 (+127%)	-9 (-10%)	-1 (-33%)	+44 (+191%)	+41 (+2050%)	+3 (New)	+8 (+160%)	Unused	+122 (+3050%)	+541 (+4508%)	+415 (+20750%)	-3080 (-50%)	+5 (+20%)
N4AB	+3975 (+2081%)	-4453 (-68%)	-1977 (-62%)	+3 (+27%)	+53 (+48%)	-625 (-50%)	Unused	-1 (-10%)	Unused	+2 (New)	-9 (-90%)	+3 (New)	-1053 (-13%)	+5 (+21%)
N4B	-126 (-20%)	+84 (+80%)	-81 (-80%)	+1 (New)	-2 (-100%)	Unused	Unused	-4 (-31%)	Unused	+324 (+1012%)	+336 (+3733%)	+1 (New)	+614 (+77%)	+5 (+36%)
N5	+70 (+318%)	-9 (-12%)	+34 (+162%)	Unused	+87 (+348%)	-8 (-80%)	Unused	+18 (+600%)	Unused	+5 (New)	-117 (-84%)	+24 (New)	+66 (+24%)	+5 (+42%)
N6	-145 (-93%)	-294 (-71%)	-381 (-96%)	-1 (-100%)	+54 (+900%)	-957 (-85%)	Unused	-5 (-50%)	Unused	-11 (-92%)	+113 (+209%)	+3 (New)	-1244 (-70%)	-1 (-5%)
N7	+65 (+812%)	-1619 (-97%)	-1665 (-100%)	-13 (-93%)	-40 (-62%)	-758 (-100%)	-9 (-100%)	+1 (+6%)	Unused	Unused	+69 (+862%)	-2 (-100%)	-2292 (-90%)	-2 (-12%)
N8	-25 (-51%)	-18 (-17%)	-94 (-90%)	-2 (-100%)	+9 (+17%)	-79 (-72%)	Unused	+5 (+71%)	Unused	-139 (-95%)	+296 (+759%)	Unused	+55 (+11%)	+5 (+36%)
N9	-307 (-66%)	+404 (+1010%)	+201 (+591%)	Unused	+32 (+80%)	+256 (+223%)	+2 (New)	+10 (+143%)	Unused	+2 (+1%)	-264 (-38%)	-10 (-67%)	+123 (+8%)	+2 (+9%)
C. Hills Totals	-2889 (-26%)	-5508 (-31%)	-4734 (-47%)	+9 (+21%)	+558 (+100%)	-2683 (-50%)	-4 (-44%)	+47 (+41%)	Unused	+1019 (+37%)	+862 (+50%)	+435 (+1176%)	-8127 (-21%)	+1 (+2%)
N1	+2402 (+10918%)	-2232 (-75%)	-305 (-85%)	-503 (-84%)	+5 (New)	+698 (+34900%)	+700 (New)	Unused	Unused	+129 (+83%)	+134 (+113%)	+2 (New)	+638 (+17%)	+8 (+62%)
N2	-494 (-100%)	-460 (-95%)	-1 (-100%)	-81 (-100%)	-2 (-40%)	+9 (+75%)	Unused	+1 (+100%)	Unused	+3 (+50%)	-146 (-94%)	Unused	-1152 (-92%)	-6 (-33%)
N3	-148 (-100%)	-1144 (-95%)	-1 (-100%)	-329 (-100%)	+10 (+333%)	-18 (-75%)	Unused	+6 (New)	Unused	-610 (-83%)	-3222 (-85%)	+11 (New)	-5446 (-87%)	-12 (-46%)
NPP1	+1818 (+6992%)	-485 (-88%)	-16 (-100%)	-206 (-60%)	+1 (New)	+264 (+400%)	+82 (New)	+1 (New)	Unused	+919 (+322%)	+3594 (+286%)	Unused	+5931 (+234%)	+7 (+44%)

Area	DABBLER	DIVER	RUDU	EAREDGR	FISHEAT	GULL	BOGU	HERON	PHAL	MEDSHOR	SMSHOR	TERN	Total	Rich-ness
Dumb.Totals	+3578 (+518%)	-4321 (-83%)	-323 (-86%)	-1119 (-83%)	+14 (+175%)	+953 (+916%)	+782 (New)	+8 (+800%)	Unused	+441 (+37%)	+360 (+7%)	+13 (New)	-29 (-0%)	+1 (+3%)
CP3C	-2326 (-86%)	+554 (+162%)	+492 (+178%)	+1 (New)	+15 (+1500%)	+47 (+15%)	Unused	-8 (-47%)	Unused	+153 (+18%)	-2970 (-66%)	+85 (New)	-4377 (-50%)	+2 (+7%)
E1	-541 (-97%)	-79 (-3%)	+100 (+9%)	-8 (-100%)	-1 (-2%)	-7 (-35%)	Unused	-5 (-50%)	Unused	+172 (+56%)	+40 (+103%)	-3 (-25%)	-431 (-12%)	+1 (+4%)
E10	+165 (+78%)	+2738 (+827%)	+2263 (+778%)	-8 (-100%)	+9 (+450%)	-14 (-74%)	Unused	-6 (-32%)	Unused	-2105 (-96%)	-1531 (-100%)	-3 (-13%)	-755 (-17%)	-9 (-28%)
E11	-572 (-79%)	-340 (-44%)	-707 (-96%)	Unused	+37 (+3700%)	-1 (-100%)	Unused	+2 (+50%)	Unused	-1441 (-97%)	-80 (-100%)	+2 (New)	-2387 (-78%)	-2 (-12%)
E12	+1532 (+141%)	+55 (+13%)	-63 (-63%)	+0 (+0%)	+14 (New)	-26 (-49%)	Unused	+14 (+64%)	Unused	-131 (-10%)	-431 (-21%)	+95 (+2375%)	+1122 (+23%)	+2 (+6%)
E13	+145 (+28%)	+2 (+7%)	+11 (New)	Unused	Unused	+3 (+300%)	Unused	+0 (+0%)	Unused	+1188 (+1449%)	+4745 (+6083%)	+0 (+0%)	+6083 (+859%)	+7 (+37%)
E14	+34 (+378%)	-1 (-100%)	Unused	Unused	Unused	+1 (New)	Unused	+8 (+800%)	Unused	+3 (+38%)	-3113 (-46%)	+1 (New)	-3065 (-46%)	+2 (+15%)
E1C	-246 (-79%)	+106 (+530%)	-2 (-50%)	Unused	Unused	Unused	Unused	+2 (New)	Unused	-93 (-42%)	-177 (-77%)	Unused	-409 (-52%)	+0 (+0%)
E2	-707 (-63%)	-7035 (-76%)	-3196 (-65%)	-1 (-50%)	+77 (+550%)	+18 (+450%)	+11 (New)	+6 (+35%)	Unused	+194 (+524%)	+164 (+57%)	-6 (-60%)	-7291 (-68%)	+15 (+58%)
E2C	+51 (+19%)	+1 (+50%)	Unused	Unused	Unused	+0 (+0%)	Unused	+1 (+25%)	Unused	-20 (-11%)	-230 (-68%)	+1 (New)	-196 (-24%)	-3 (-17%)
E4	-8822 (-91%)	+33 (+412%)	Unused	Unused	+2 (New)	+1 (+33%)	Unused	+22 (+733%)	Unused	+445 (+50%)	-12257 (-96%)	+6 (New)	-20585 (-88%)	+4 (+21%)
E4C	-220 (-65%)	+162 (+110%)	-48 (-51%)	-2 (-100%)	Unused	+2 (+100%)	Unused	+1 (New)	Unused	+383 (+57%)	-2048 (-29%)	Unused	-1749 (-21%)	-3 (-16%)
E5	-160 (-20%)	-750 (-93%)	+42 (+2100%)	-3 (-50%)	Unused	-197 (-100%)	-193 (-100%)	-1 (-100%)	Unused	-256 (-64%)	-180 (-90%)	Unused	-1546 (-64%)	-5 (-29%)
E5C	-64 (-85%)	+45 (+105%)	Unused	Unused	Unused	Unused	Unused	+1 (New)	Unused	-86 (-80%)	-119 (-84%)	Unused	-241 (-62%)	+0 (+0%)
E6	+100 (+278%)	-4 (-2%)	+149 (+2129%)	-80 (-94%)	Unused	+5 (+31%)	Unused	Unused	-8 (-100%)	-241 (-80%)	+84 (+7%)	Unused	-145 (-8%)	+2 (+11%)
E6A	+604 (+53%)	-1274 (-24%)	-884 (-20%)	-26 (-84%)	-21 (-48%)	+8 (+100%)	Unused	-20 (-59%)	Unused	+33 (+9%)	+629 (+18%)	-14 (-88%)	-91 (-1%)	+1 (+3%)
E6B	+205 (+133%)	+1133 (+199%)	+1201 (+263%)	-20 (-100%)	+1 (New)	+31 (New)	Unused	+0 (+0%)	Unused	+152 (+148%)	+3431 (+335%)	+3 (New)	+4936 (+263%)	+11 (+65%)
E6C	+645 (+1466%)	-8 (-9%)	+22 (+2200%)	Unused	Unused	+44 (New)	+44 (New)	+1 (New)	Unused	+1 (New)	-49 (-89%)	Unused	+634 (+339%)	+4 (+80%)
E7	+135 (+293%)	-6395 (-94%)	-6679 (-100%)	-8 (-100%)	-25 (-68%)	+7 (+233%)	+2 (New)	+1 (+25%)	Unused	-180 (-97%)	-62 (-60%)	+72 (+189%)	-6462 (-89%)	-2 (-9%)
E8	-199 (-17%)	-709 (-75%)	-563 (-79%)	-4 (-100%)	-7 (-100%)	-3 (-100%)	Unused	-3 (-60%)	Unused	-60 (-7%)	-2846 (-83%)	Unused	-3831 (-60%)	-4 (-15%)
E8AE	-274 (-89%)	Unused	Unused	Unused	Unused	-1 (-50%)	Unused	+0 (+0%)	Unused	-374 (-80%)	+141 (+42%)	Unused	-510 (-46%)	-4 (-27%)
E8AW	+55 (+104%)	+13 (+650%)	Unused	Unused	Unused	+1 (New)	Unused	+0 (+0%)	Unused	-1616 (-99%)	Unused	Unused	-1547 (-91%)	-2 (-18%)

Area	DABBLER	DIVER	RUDU	EAREDGR	FISHEAT	GULL	BOGU	HERON	PHAL	MEDSHOR	SMSHOR	TERN	Total	Rich-ness
E8XN	+17 (New)	+213 (+81%)	-65 (-29%)	Unused	+4 (+200%)	Unused	Unused	+3 (+100%)	Unused	Unused	Unused	+1 (New)	+238 (+89%)	+7 (+100%)
E8XS	-81 (-75%)	+2 (New)	Unused	Unused	Unused	Unused	Unused	+2 (New)	Unused	-1 (-100%)	Unused	Unused	-78 (-72%)	-1 (-17%)
E9	-315 (-10%)	-203 (-68%)	-1 (-100%)	Unused	+6 (+200%)	-1 (-25%)	Unused	+10 (New)	Unused	-2374 (-99%)	-154 (-100%)	Unused	-3033 (-51%)	-3 (-14%)
Eden Totals	-10839 (-44%)	-11741 (-40%)	-7928 (-39%)	-159 (-91%)	+111 (+74%)	-82 (-12%)	-136 (-70%)	+31 (+19%)	-8 (-100%)	-6254 (-42%)	-17013 (-37%)	+240 (+231%)	-45716 (-39%)	+3 (+5%)
M1	+1733 (+833%)	-1455 (-85%)	-559 (-70%)	+1307 (+10892%)	-33 (-94%)	+76 (+35%)	Unused	-4 (-80%)	Unused	-1237 (-60%)	-3745 (-59%)	-42 (-100%)	-3374 (-32%)	-4 (-15%)
M2	+7318 (+9035%)	+522 (+1214%)	+224 (+22400%)	+2107 (+52675%)	-7 (-100%)	-135 (-20%)	-1 (-100%)	Unused	Unused	-1733 (-65%)	-7141 (-93%)	-154 (-99%)	+784 (+7%)	-1 (-4%)
M3	+1426 (+245%)	+432 (+3086%)	+49 (+2450%)	+628 (+21%)	Unused	-582 (-80%)	-120 (-100%)	+1 (New)	Unused	+1523 (+1603%)	+6815 (+847%)	-2 (-100%)	+10243 (+198%)	+3 (+14%)
M4	-1342 (-46%)	+215 (+169%)	-8 (-73%)	-4723 (-58%)	Unused	-587 (-38%)	-68 (-100%)	Unused	Unused	-76 (-70%)	-330 (-61%)	Unused	-6839 (-51%)	-2 (-12%)
M5	-4040 (-94%)	-431 (-92%)	-9 (-100%)	-4149 (-91%)	Unused	-1590 (-70%)	-1084 (-100%)	Unused	Unused	-200 (-70%)	+2866 (+6514%)	Unused	-7545 (-63%)	-3 (-18%)
M6	-1000 (-100%)	+809 (+4494%)	Unused	-2497 (-100%)	Unused	-280 (-85%)	Unused	Unused	Unused	-995 (-99%)	-1282 (-59%)	Unused	-5247 (-75%)	+3 (+25%)
Mowry Totals	+4095 (+45%)	+92 (+4%)	-303 (-37%)	-7327 (-40%)	-40 (-95%)	-3098 (-54%)	-1273 (-100%)	-3 (-60%)	Unused	-2718 (-44%)	-2817 (-16%)	-198 (-99%)	-11978 (-20%)	-1 (-3%)
R1	-34 (-21%)	-778 (-65%)	-366 (-62%)	-5 (-83%)	-4 (-57%)	+16 (+533%)	Unused	+3 (+30%)	Unused	-1403 (-60%)	-41936 (-71%)	+19 (+380%)	-44112 (-70%)	+3 (+10%)
R2	+7 (+117%)	+53 (+43%)	-1 (-100%)	-4 (-100%)	Unused	-7 (-64%)	Unused	Unused	-6 (-100%)	-342 (-68%)	+3256 (+1021%)	+7 (New)	+2966 (+306%)	+0 (+0%)
R3	-25 (-100%)	-88 (-95%)	Unused	-5 (-100%)	-4 (-100%)	-1 (-100%)	Unused	+7 (New)	Unused	-350 (-88%)	-4005 (-98%)	Unused	-4420 (-95%)	-4 (-27%)
R4	-1260 (-100%)	-631 (-100%)	Unused	-27 (-100%)	+1 (New)	-14 (-100%)	Unused	+3 (New)	Unused	-972 (-70%)	-7140 (-73%)	+57 (+1425%)	-9978 (-76%)	-9 (-45%)
R5	-2 (-20%)	+1 (New)	Unused	Unused	Unused	Unused	Unused	+1 (New)	Unused	+53 (+662%)	+160 (+59%)	Unused	+305 (+103%)	+9 (+180%)
R5S	-206 (-96%)	+7 (+700%)	Unused	Unused	Unused	Unused	Unused	+1 (New)	Unused	+10 (+143%)	-795 (-100%)	Unused	-975 (-96%)	+2 (+50%)
RSF2U1	+224 (+46%)	+5 (+1%)	-64 (-69%)	Unused	+0 (+0%)	+21 (+140%)	Unused	+26 (+520%)	Unused	+3836 (+227%)	+387 (+95%)	+14 (New)	+4517 (+150%)	+14 (+70%)
RSF2U2	-1121 (-82%)	-54 (-44%)	-1 (-100%)	-1 (-100%)	-2 (-100%)	+12 (+86%)	Unused	+4 (+200%)	Unused	-4701 (-62%)	+572 (+358%)	-2 (-67%)	-5291 (-57%)	-2 (-7%)
RSF2U3	-4 (-100%)	-16 (-19%)	Unused	Unused	Unused	+3 (+100%)	Unused	Unused	Unused	+26 (+96%)	-1585 (-84%)	Unused	-1579 (-79%)	-3 (-20%)
RSF2U4	-49 (-94%)	+195 (+25%)	+301 (+52%)	-1 (-100%)	Unused	Unused	Unused	+1 (+100%)	Unused	-37 (-100%)	-366 (-100%)	Unused	-254 (-20%)	-10 (-56%)
Ravens. Totals	-2470 (-69%)	-1306 (-38%)	-131 (-10%)	-43 (-98%)	-9 (-64%)	+30 (+49%)	Unused	+46 (+256%)	-6 (-100%)	-3880 (-28%)	-51452 (-66%)	+95 (+792%)	-58821 (-60%)	-3 (-6%)
Grand Total	-6864 (-8%)	-48018 (-38%)	-17412 (-27%)	-7877 (-39%)	+1281 (+57%)	-4244 (-18%)	+105 (+7%)	+57 (+8%)	-14 (-100%)	-8826 (-18%)	-105578 (-56%)	+418 (+68%)	-179302 (-36%)	+6 (+9%)

Table A2.7. Waterbird species richness and total sightings in spring (March 2024 - May 2024) in South San Francisco Bay, California. RUDU counts are also included in counts of the DIVER guild and BOGU in counts of the GULL guild.

Area	**DABB-L ER**	**DIVER**	**RUDU**	**EARED GR**	**FISH-E AT**	**GULL**	**BOGU**	**HERON**	**PHAL**	**MED SHOR**	**SM SHOR**	**TERN**	**Total**	**Rich-ness**
A1	36	682	420	4	36	2	0	8	0	0	0	36	807	19
A10	26	141	78	0	43	32	0	4	0	0	0	8	255	17
A11	42	122	17	0	34	17	0	4	0	40	0	5	264	17
A12	0	0	0	0	0	87	0	0	0	2	0	0	89	3
A13	31	58	0	3	0	64	0	0	0	33	2069	0	2258	15
A14	3376	873	593	176	114	25	0	3	0	0	0	80	4657	25
A15	2	0	0	0	0	32	0	0	0	51	3174	0	3266	14
A16	2869	305	170	5	105	79	0	56	0	251	6	559	4306	35
A17	465	14	14	0	3	522	0	2	0	164	4	5	1218	19
A19	620	43	17	0	0	1150	0	0	0	16	0	0	1870	10
A22	36	3	1	0	0	8	0	0	0	81	923	6	1057	17
A23	0	0	0	0	0	17	0	0	0	6	0	0	23	2
A2E	103	489	485	43	17	2239	0	15	0	5	0	4	2920	13
A2W	24	208	172	4	358	7	0	19	0	4	0	37	661	21
A3N	74	209	205	0	3	0	0	58	0	558	60	29	1001	15
A3W	603	1177	935	34	94	68	0	33	0	1	0	92	2106	22
A5	273	2500	290	70	511	830	264	29	900	11	0	5	5146	29
A6S	76	16	16	0	0	0	0	1	0	24	21	0	144	10
A7	591	44	25	0	188	1821	169	8	377	6	3	4	3047	25
A8	97	901	392	69	34	844	0	14	0	7	0	6	1986	23
A8S	132	382	280	48	45	752	3	19	0	15	0	3	1431	32
A8W	99	127	112	57	33	266	0	7	0	12	0	3	609	20
A9	4276	835	835	0	0	110	26	6	0	979	207	60	6473	20
AB1	1703	593	593	0	25	60	0	4	0	990	485	61	3924	19
AB2	220	53	53	0	20	2235	0	4	0	239	907	5	3687	23
Alviso Total	15774	9775	5703	513	1663	11267	462	294	1277	3495	7859	1008	53205	56
N1A	8	315	286	0	31	102	0	17	0	168	178	26	850	26
N2A	2	364	348	11	89	1013	0	8	0	0	0	4	1492	17
N3A	39	1309	1130	1	156	2353	3	11	1	321	1892	36	6126	30
N4	0	5	5	0	12	320	0	13	0	22	7	6	390	17
N4AA	240	1340	1339	2	7	3	0	30	0	30	739	11	2413	25
N4AB	7	522	477	32	107	1090	0	21	0	5	0	23	1826	21

Area	DABB-LER	DIVER	RUDU	EARED GR	FISH-EAT	GULL	BOGU	HERON	PHAL	MED SHOR	SM SHOR	TERN	Total	Rich-ness
N4B	8	220	122	0	0	2	0	1	0	21	0	0	254	9
N5	6	81	79	0	25	76	0	8	0	0	0	11	216	13
N6	5	196	52	0	53	1430	0	0	0	8	0	3	1696	11
N7	7	1038	442	12	30	2224	0	6	0	1	0	2	3331	16
N8	4	269	177	0	0	297	0	4	0	2	193	0	1141	10
N9	3	591	374	0	2	2092	0	0	0	19	150	0	2867	14
C. Hills Total	329	6250	4831	58	512	11002	3	119	1	597	3159	122	22602	48
N1	1696	552	60	207	0	544	493	1	16	24	20	9	3080	16
N2	35	0	0	0	1	0	0	3	0	10	3	1	57	9
N3	4	0	0	0	5	1	0	5	0	11	9	9	51	12
NPP1	1032	51	42	574	0	54	3	1	0	194	459	0	2374	18
Dumb. Total	2767	603	102	781	6	599	496	10	16	239	491	19	5562	28
CP3C	2653	260	234	0	8	76	0	23	0	533	4422	9	8006	30
E1	17	764	343	0	34	5	0	8	0	25	118	55	1026	23
E10	727	264	92	0	5	3	0	2	0	1081	514	34	2630	26
E11	21	0	0	0	0	5	0	4	0	386	35	2	454	11
E12	455	324	173	1	6	5	1	11	0	295	1619	50	2768	30
E13	102	374	335	0	3	0	0	10	0	179	4708	1	5377	27
E14	0	0	0	0	0	0	0	1	0	6	4595	0	4603	11
E1C	111	0	0	0	0	0	0	4	0	41	523	0	679	13
E2	825	1270	973	0	33	4	0	49	0	379	1371	76	4016	26
E2C	283	1	1	0	0	3	0	5	0	225	2749	0	3267	19
E4	406	231	15	0	0	0	0	11	0	3	0	0	651	9
E4C	123	49	16	0	1	0	0	2	0	219	4011	0	4407	19
E5	331	28	1	0	0	0	0	1	0	24	33	0	419	9
E5C	1060	9	0	0	0	1	0	8	0	211	4222	0	5511	15
E6	226	29	25	0	0	17	0	0	16	212	408	0	911	18
E6A	578	58	46	0	5	104	0	28	0	293	1661	34	2799	27
E6B	56	0	0	0	0	0	0	1	0	26	3798	1	3883	13
E6C	718	7	4	2	0	2	0	0	0	1329	746	7	2812	18
E7	3826	128	10	0	10	0	0	16	0	621	60	138	4799	19
E8	269	40	29	0	0	0	0	15	0	93	155	2	574	17
E8AE	11	30	0	0	1	0	0	3	0	0	356	0	401	9
E8AW	4	1	0	0	0	0	0	1	0	1	0	1	8	5

Area	DABB-LER	DIVER	RUDU	EARED GR	FISH-EAT	GULL	BOGU	HERON	PHAL	MED SHOR	SM SHOR	TERN	Total	Rich-ness
E8XN	2	183	176	0	0	0	0	1	0	1	0	4	191	8
E8XS	21	0	0	0	0	0	0	0	0	0	50	0	71	3
E9	273	60	11	0	8	0	0	8	0	488	3809	0	4647	25
Eden Total	13098	4110	2484	3	114	225	1	212	16	6671	39963	414	64910	50
M1	88	386	382	1314	1	1315	0	0	0	26	592	0	3735	14
M2	119	201	2	1324	0	1402	0	0	0	1313	2075	4	6451	15
M3	83	19	0	1771	0	1676	0	0	0	83	1043	0	4685	16
M4	49	28	0	793	0	1267	0	0	0	1	0	0	2140	9
M5	39	60	0	972	0	683	0	0	0	31	2	0	1790	10
M6	0	55	0	49	0	198	0	0	0	2	160	0	471	7
Mowry Total	378	749	384	6223	1	6541	0	0	0	1456	3872	4	19272	23
R1	256	456	352	1	16	6	0	12	0	119	11833	26	12745	29
R2	0	0	0	0	0	120	1	1	12	123	13827	0	14083	15
R3	616	329	0	2	2	0	0	2	0	243	67	13	1292	21
R4	13	0	0	0	0	29	0	3	0	8	3075	1	3131	14
R5	39	0	0	0	0	0	0	3	0	26	0	0	93	12
R5S	37	0	0	0	0	0	0	2	0	48	140	0	233	12
RSF2U1	319	242	84	0	2	378	0	5	0	2189	1290	271	4701	26
RSF2U2	553	276	244	0	2	307	0	3	0	1542	860	277	3836	27
RSF2U3	31	60	0	0	0	67	0	0	0	55	1258	0	1478	17
RSF2U4	4	601	596	0	2	0	0	1	0	1	0	2	615	10
Ravens. Total	1868	1964	1276	3	24	907	1	32	12	4354	32350	590	42207	45
Grand Total	34214	23451	14780	7581	2320	30541	963	667	1322	16812	87694	2157	207758	64

Table A2.8. Change in waterbird species richness and total sightings in spring (March 2024 - May 2024 compared to March 2023 - May 2023) in South San Francisco Bay, California. Percent change from the previous year is listed in parentheses; New indicates sites that were new colonizations (zero abundance in the previous period). Sites that were unoccupied by a guild in both periods are listed as Unused. RUDU counts are also included in counts of the DIVER guild and BOGU in counts of the GULL guild.

Area	DABBLER	DIVER	RUDU	EAREDGR	FISHEAT	GULL	BOGU	HERON	PHAL	MEDSHOR	SMSHOR	TERN	Total	Richness
A1	-42 (-54%)	-1203 (-64%)	-563 (-57%)	-55 (-93%)	-25 (-41%)	-27 (-93%)	Unused	-14 (-64%)	Unused	-3 (-100%)	Unused	+20 (+125%)	-1357 (-63%)	-7 (-27%)
A10	+21 (+420%)	-406 (-74%)	-459 (-85%)	-1 (-100%)	-77 (-64%)	+9 (+39%)	Unused	-5 (-56%)	Unused	Unused	Unused	-7 (-47%)	-467 (-65%)	-5 (-23%)
A11	+11 (+35%)	-16 (-12%)	-32 (-65%)	-119 (-100%)	-111 (-77%)	-14 (-45%)	Unused	+3 (+300%)	Unused	+40 (New)	-9 (-100%)	+4 (+400%)	-214 (-45%)	-4 (-19%)
A12	Unused	Unused	Unused	Unused	Unused	-145 (-62%)	Unused	Unused	Unused	+0 (+0%)	-3 (-100%)	Unused	-149 (-63%)	-5 (-62%)
A13	+31 (New)	-167 (-74%)	-14 (-100%)	-59 (-95%)	-4 (-100%)	-94 (-59%)	Unused	Unused	Unused	-32 (-49%)	-1066 (-34%)	-11 (-100%)	-1402 (-38%)	-3 (-17%)
A14	+668 (+25%)	-3568 (-80%)	-1109 (-65%)	-62 (-26%)	-50 (-30%)	-14 (-36%)	Unused	-4 (-57%)	Unused	-9 (-100%)	-11 (-100%)	+75 (+1500%)	-2970 (-39%)	-2 (-7%)
A15	-1 (-33%)	-62 (-100%)	Unused	-12 (-100%)	Unused	-996 (-97%)	Unused	Unused	Unused	+26 (+104%)	-5173 (-62%)	-2 (-100%)	-6218 (-66%)	-4 (-22%)
A16	-1787 (-38%)	-1280 (-81%)	-618 (-78%)	-15 (-75%)	+55 (+110%)	-189 (-71%)	Unused	+32 (+133%)	Unused	+88 (+54%)	-558 (-99%)	-10 (-2%)	-3615 (-46%)	-8 (-19%)
A17	-1087 (-70%)	-132 (-90%)	-62 (-82%)	-3 (-100%)	-23 (-88%)	+376 (+258%)	Unused	-2 (-50%)	Unused	+77 (+89%)	-516 (-99%)	+5 (New)	-1273 (-51%)	-3 (-14%)
A19	+366 (+144%)	+32 (+291%)	+17 (New)	Unused	Unused	+204 (+22%)	Unused	Unused	Unused	+16 (New)	Unused	Unused	+624 (+50%)	+2 (+25%)
A22	-933 (-96%)	-44 (-94%)	+1 (New)	Unused	Unused	-408 (-98%)	Unused	Unused	-10 (-100%)	-184 (-69%)	+910 (+7000%)	+6 (New)	-681 (-39%)	-1 (-6%)
A23	-5 (-100%)	-21 (-100%)	Unused	Unused	Unused	-231 (-93%)	Unused	Unused	Unused	-128 (-96%)	-66 (-100%)	Unused	-462 (-95%)	-11 (-85%)
A2E	-8831 (-99%)	-5743 (-92%)	-4495 (-90%)	+39 (+975%)	-7 (-29%)	+797 (+55%)	Unused	+3 (+25%)	Unused	-80 (-94%)	-464 (-100%)	-4 (-50%)	-14294 (-83%)	-14 (-52%)
A2W	-139 (-85%)	-2692 (-93%)	-2137 (-93%)	-41 (-91%)	+239 (+201%)	+4 (+133%)	Unused	+11 (+138%)	Unused	-8 (-67%)	-96 (-100%)	+31 (+517%)	-2704 (-80%)	-10 (-32%)
A3N	-13 (-15%)	+195 (+1393%)	+193 (+1608%)	Unused	+0 (+0%)	-7 (-100%)	Unused	+57 (+5700%)	Unused	+398 (+249%)	-5950 (-99%)	+26 (+867%)	-5284 (-84%)	+3 (+25%)
A3W	-4124 (-87%)	+71 (+6%)	-157 (-14%)	+34 (New)	-34 (-27%)	-542 (-89%)	Unused	+8 (+32%)	Unused	-501 (-100%)	-5600 (-100%)	-37 (-29%)	-10723 (-84%)	-1 (-4%)
A5	+186 (+214%)	+1987 (+387%)	+17 (+6%)	+63 (+900%)	-4 (-1%)	-2820 (-77%)	+264 (New)	+16 (+123%)	+900 (New)	+2 (+22%)	-6 (-100%)	-14 (-74%)	+305 (+6%)	-2 (-6%)
A6S	+17 (+29%)	+5 (+45%)	+5 (+45%)	Unused	Unused	-35 (-100%)	Unused	+1 (New)	Unused	-164 (-87%)	-51 (-71%)	Unused	-225 (-61%)	-2 (-17%)
A7	+547 (+1243%)	-163 (-79%)	-6 (-19%)	-1 (-100%)	+5 (+3%)	-1094 (-38%)	+169 (New)	+2 (+33%)	+377 (New)	+6 (New)	+3 (New)	-2 (-33%)	-335 (-10%)	+5 (+25%)
A8	+21 (+28%)	-1693 (-65%)	-220 (-36%)	+46 (+200%)	-32 (-48%)	-161 (-16%)	Unused	+11 (+367%)	Unused	+7 (New)	Unused	+2 (+50%)	-1791 (-47%)	-2 (-8%)

Area	DABBLER	DIVER	RUDU	EAREDGR	FISHEAT	GULL	BOGU	HERON	PHAL	MEDSHOR	SMSHOR	TERN	Total	Rich-ness
A8S	+47 (+55%)	-460 (-55%)	-444 (-61%)	-100 (-68%)	-8 (-15%)	-537 (-42%)	+3 (New)	+19 (New)	Unused	+13 (+650%)	-9 (-100%)	+3 (New)	-1006 (-41%)	+15 (+88%)
A8W	+85 (+607%)	+70 (+123%)	+70 (+167%)	+49 (+612%)	+23 (+230%)	-247 (-48%)	Unused	+7 (New)	Unused	+12 (New)	Unused	+3 (New)	+2 (+0%)	+6 (+43%)
A9	+383 (+10%)	-355 (-30%)	-350 (-30%)	Unused	-5 (-100%)	-120 (-52%)	+26 (New)	-7 (-54%)	Unused	-180 (-16%)	-4071 (-95%)	+40 (+200%)	-4328 (-40%)	-4 (-17%)
AB1	+1412 (+485%)	+428 (+259%)	+540 (+1019%)	Unused	+16 (+178%)	-9 (-13%)	Unused	-4 (-50%)	Unused	-344 (-26%)	-7557 (-94%)	+61 (New)	-5997 (-60%)	-9 (-32%)
AB2	-80 (-27%)	-141 (-73%)	-116 (-69%)	Unused	+3 (+18%)	-2916 (-57%)	Unused	+4 (New)	Unused	+45 (+23%)	-6395 (-88%)	+5 (New)	-9472 (-72%)	+6 (+35%)
Alviso Total	-13247 (-46%)	-15358 (-61%)	-9939 (-64%)	-237 (-32%)	-39 (-2%)	-9216 (-45%)	+462 (New)	+138 (+88%)	+1267 (+12670%)	-903 (-21%)	-36688 (-82%)	+194 (+24%)	-74036 (-58%)	-4 (-7%)
N1A	-2 (-20%)	-88 (-22%)	-82 (-22%)	-1 (-100%)	-112 (-78%)	-55 (-35%)	Unused	+6 (+55%)	Unused	+148 (+740%)	+168 (+1680%)	-2 (-7%)	+66 (+8%)	+3 (+13%)
N2A	+2 (New)	+20 (+6%)	+25 (+8%)	+10 (+1000%)	+2 (+2%)	-734 (-42%)	Unused	+5 (+167%)	Unused	Unused	Unused	-8 (-67%)	-706 (-32%)	+3 (+21%)
N3A	+10 (+34%)	-2857 (-69%)	-2163 (-66%)	+1 (New)	-115 (-42%)	-443 (-16%)	+3 (New)	-2 (-15%)	+1 (New)	+320 (+32000%)	+1726 (+1040%)	+31 (+620%)	-1325 (-18%)	+8 (+36%)
N4	-2 (-100%)	-11 (-69%)	+5 (New)	Unused	+0 (+0%)	+105 (+49%)	Unused	-4 (-24%)	Unused	-1140 (-98%)	-15 (-68%)	+0 (+0%)	-1066 (-73%)	+1 (+6%)
N4AA	+159 (+196%)	-1194 (-47%)	+139 (+12%)	+2 (New)	-4 (-36%)	+3 (New)	Unused	+15 (+100%)	Unused	+27 (+900%)	+739 (New)	+10 (+1000%)	-237 (-9%)	+4 (+19%)
N4AB	+4 (+133%)	-556 (-52%)	-435 (-48%)	+32 (New)	-19 (-15%)	-723 (-40%)	Unused	+11 (+110%)	Unused	+5 (New)	Unused	+9 (+64%)	-1220 (-40%)	+5 (+31%)
N4B	-2 (-20%)	+42 (+24%)	+44 (+56%)	Unused	Unused	+2 (New)	Unused	-8 (-89%)	Unused	+19 (+950%)	-25 (-100%)	Unused	+26 (+11%)	-1 (-10%)
N5	-13 (-68%)	+77 (+1925%)	+79 (New)	Unused	+15 (+150%)	-173 (-69%)	Unused	+3 (+60%)	Unused	Unused	-10 (-100%)	+9 (+450%)	-89 (-29%)	+2 (+18%)
N6	-1 (-17%)	-565 (-74%)	-591 (-92%)	Unused	+46 (+657%)	-2472 (-63%)	Unused	-5 (-100%)	Unused	-6 (-43%)	-490 (-100%)	+1 (+50%)	-3492 (-67%)	-4 (-27%)
N7	+5 (+250%)	+969 (+1404%)	+406 (+1128%)	+12 (New)	+16 (+114%)	+79 (+4%)	Unused	+5 (+500%)	Unused	+1 (New)	Unused	-2 (-50%)	+1094 (+49%)	+6 (+60%)
N8	+4 (New)	+206 (+327%)	+140 (+378%)	Unused	-12 (-100%)	-76 (-20%)	Unused	+4 (New)	Unused	-91 (-98%)	-19 (-9%)	-2 (-100%)	+386 (+51%)	+0 (+0%)
N9	-4 (-57%)	+298 (+102%)	+145 (+63%)	Unused	-12 (-86%)	+1068 (+104%)	Unused	-4 (-100%)	Unused	-70 (-79%)	-403 (-73%)	Unused	+878 (+44%)	-6 (-30%)
Coyote Hills Total	+160 (+95%)	-3659 (-37%)	-2288 (-32%)	+56 (+2800%)	-195 (-28%)	-3419 (-24%)	+3 (New)	+26 (+28%)	+1 (New)	-787 (-57%)	+1671 (+112%)	+46 (+61%)	-5685 (-20%)	+4 (+9%)
N1	+1676 (+8380%)	-815 (-60%)	-557 (-90%)	-1305 (-86%)	Unused	+351 (+182%)	+493 (New)	+1 (New)	+16 (New)	+0 (+0%)	-93 (-82%)	+5 (+125%)	-156 (-5%)	+0 (+0%)
N2	+35 (New)	-252 (-100%)	Unused	-84 (-100%)	+1 (New)	-24 (-100%)	Unused	+3 (New)	Unused	+4 (+67%)	-75 (-96%)	+1 (New)	-394 (-87%)	-5 (-36%)
N3	+4 (New)	-155 (-100%)	-2 (-100%)	-124 (-100%)	+4 (+400%)	-2 (-67%)	Unused	-2 (-29%)	Unused	-830 (-99%)	-1231 (-99%)	+9 (New)	-2321 (-98%)	-6 (-33%)
NPP1	+1032 (New)	-438 (-90%)	+17 (+68%)	+509 (+783%)	Unused	-199 (-79%)	+3 (New)	+1 (New)	Unused	+29 (+18%)	-4818 (-91%)	Unused	-3877 (-62%)	+0 (+0%)

Area	DABBLER	DIVER	RUDU	EAREDGR	FISHEAT	GULL	BOGU	HERON	PHAL	MEDSHOR	SMSHOR	TERN	Total	Rich-ness
Dumbarton Total	+2747 (+13735%)	-1660 (-73%)	-542 (-84%)	-1004 (-56%)	+5 (+500%)	+126 (+27%)	+496 (New)	+3 (+43%)	+16 (New)	-797 (-77%)	-6217 (-93%)	+15 (+375%)	-6748 (-55%)	+0 (+0%)
CP3C	+827 (+45%)	-310 (-54%)	-271 (-54%)	Unused	+7 (+700%)	+21 (+38%)	Unused	+21 (+1050%)	Unused	+517 (+3231%)	+2566 (+138%)	+6 (+200%)	+3668 (+85%)	+14 (+88%)
E1	-114 (-87%)	-1164 (-60%)	-182 (-35%)	Unused	-17 (-33%)	-4 (-44%)	Unused	+3 (+60%)	Unused	+22 (+733%)	+66 (+127%)	+32 (+139%)	-1180 (-53%)	+3 (+15%)
E10	+455 (+167%)	-1702 (-87%)	-1690 (-95%)	Unused	+4 (+400%)	+2 (+200%)	Unused	-3 (-60%)	Unused	+930 (+616%)	+192 (+60%)	+23 (+209%)	-103 (-4%)	+3 (+13%)
E11	-984 (-98%)	-19 (-100%)	Unused	Unused	Unused	-12 (-71%)	Unused	-7 (-64%)	Unused	-484 (-56%)	-2602 (-99%)	-3 (-60%)	-4112 (-90%)	-10 (-48%)
E12	-719 (-61%)	+127 (+64%)	+38 (+28%)	-1 (-50%)	+2 (+50%)	+2 (+67%)	+1 (New)	+4 (+57%)	Unused	-149 (-34%)	+935 (+137%)	+40 (+400%)	+241 (+10%)	+8 (+36%)
E13	-588 (-85%)	+208 (+125%)	+236 (+238%)	-2 (-100%)	-16 (-84%)	Unused	Unused	+3 (+43%)	Unused	-327 (-65%)	+1997 (+74%)	-28 (-97%)	+1247 (+30%)	-1 (-4%)
E14	-3 (-100%)	Unused	Unused	Unused	Unused	Unused	Unused	+0 (+0%)	Unused	+5 (+500%)	+4009 (+684%)	-6 (-100%)	+4002 (+666%)	+1 (+10%)
E1C	-421 (-79%)	Unused	Unused	Unused	Unused	-1 (-100%)	Unused	+3 (+300%)	Unused	-64 (-61%)	-3787 (-88%)	Unused	-4276 (-86%)	+1 (+8%)
E2	-317 (-28%)	-1565 (-55%)	-1677 (-63%)	Unused	-60 (-65%)	-59 (-94%)	Unused	+18 (+58%)	Unused	+102 (+37%)	+966 (+239%)	-1 (-1%)	-912 (-19%)	+2 (+8%)
E2C	+53 (+23%)	-2 (-67%)	-2 (-67%)	Unused	Unused	+3 (New)	Unused	+5 (New)	Unused	+167 (+288%)	+1449 (+111%)	Unused	+1674 (+105%)	+9 (+90%)
E4	+13 (+3%)	-222 (-49%)	-424 (-97%)	Unused	-9 (-100%)	Unused	Unused	+4 (+57%)	Unused	+1 (+50%)	Unused	-2 (-100%)	-217 (-25%)	-4 (-31%)
E4C	-175 (-59%)	+27 (+123%)	-4 (-20%)	Unused	+1 (New)	-144 (-100%)	-13 (-100%)	+2 (New)	Unused	+121 (+123%)	+2601 (+184%)	Unused	+2430 (+123%)	+4 (+27%)
E5	+232 (+234%)	-185 (-87%)	-98 (-99%)	-1 (-100%)	Unused	-1 (-100%)	Unused	-3 (-75%)	Unused	+22 (+1100%)	-422 (-93%)	-13 (-100%)	-375 (-47%)	-8 (-47%)
E5C	+279 (+36%)	+6 (+200%)	Unused	Unused	Unused	+1 (New)	Unused	+8 (New)	Unused	-274 (-56%)	+2180 (+107%)	Unused	+2195 (+66%)	+6 (+67%)
E6	+199 (+737%)	-440 (-94%)	-412 (-94%)	Unused	-2 (-100%)	+1 (+6%)	Unused	-1 (-100%)	+16 (New)	+209 (+6967%)	-103 (-20%)	Unused	-123 (-12%)	-1 (-5%)
E6A	-1774 (-75%)	-523 (-90%)	-463 (-91%)	-12 (-100%)	-1 (-17%)	+90 (+643%)	Unused	+2 (+8%)	Unused	-82 (-22%)	-11308 (-87%)	+12 (+55%)	-13571 (-83%)	-12 (-31%)
E6B	-206 (-79%)	-52 (-100%)	-44 (-100%)	Unused	-1 (-100%)	-2 (-100%)	Unused	-8 (-89%)	Unused	-166 (-86%)	-1181 (-24%)	-2 (-67%)	-1622 (-29%)	-8 (-38%)
E6C	+533 (+288%)	-62 (-90%)	+4 (New)	+1 (+100%)	-1 (-100%)	+1 (+100%)	Unused	-2 (-100%)	Unused	+1329 (New)	+361 (+94%)	-4 (-36%)	+2153 (+327%)	+4 (+29%)
E7	+3238 (+551%)	-2529 (-95%)	-2471 (-100%)	Unused	-18 (-64%)	Unused	Unused	+8 (+100%)	Unused	+620 (+62000%)	-145 (-71%)	+68 (+97%)	+1240 (+35%)	+1 (+6%)
E8	-71 (-21%)	+27 (+208%)	+19 (+190%)	Unused	Unused	-1 (-100%)	Unused	+4 (+36%)	Unused	-582 (-86%)	-3295 (-96%)	+2 (New)	-3916 (-87%)	+0 (+0%)
E8AE	+11 (New)	+30 (New)	Unused	Unused	+1 (New)	Unused	Unused	+1 (+50%)	Unused	-79 (-100%)	-844 (-70%)	Unused	-880 (-69%)	+3 (+50%)
E8AW	-3 (-43%)	-44 (-98%)	Unused	Unused	Unused	Unused	Unused	-1 (-50%)	Unused	-103 (-99%)	-775 (-100%)	-2 (-67%)	-928 (-99%)	-6 (-55%)

Area	DABBLER	DIVER	RUDU	EAREDGR	FISHEAT	GULL	BOGU	HERON	PHAL	MEDSHOR	SMSHOR	TERN	Total	Rich-ness
E8XN	-6 (-75%)	341 (-65%)	-255 (-59%)	Unused	-3 (-100%)	Unused	Unused	-6 (-86%)	Unused	+1 (New)	Unused	+3 (+300%)	-352 (-65%)	-3 (-27%)
E8XS	+17 (+425%)	Unused	Unused	Unused	Unused	Unused	Unused	Unused	Unused	-1 (-100%)	-240 (-83%)	Unused	-226 (-76%)	-4 (-57%)
E9	-566 (-67%)	-56 (-48%)	+9 (+450%)	Unused	+4 (+100%)	-240 (-100%)	Unused	-3 (-27%)	Unused	-2806 (-85%)	-1122 (-23%)	-13 (-100%)	-4803 (-51%)	+1 (+4%)
Eden Landing Total	-90 (-1%)	-8791 (-68%)	-7687 (-76%)	-15 (-83%)	-109 (-49%)	-343 (-60%)	-12 (-92%)	+52 (+32%)	+16 (New)	-1071 (-14%)	-8502 (-18%)	+112 (+37%)	-18746 (-22%)	-1 (-2%)
M1	+88 (New)	+386 (New)	+382 (New)	+1251 (+1986%)	-7 (-88%)	-42 (-3%)	Unused	-3 (-100%)	Unused	-96 (-79%)	-73 (-11%)	-21 (-100%)	+1492 (+67%)	+4 (+40%)
M2	+119 (New)	+198 (+6600%)	+2 (New)	+1320 (+33000%)	-2 (-100%)	-896 (-39%)	Unused	Unused	Unused	+1192 (+985%)	+1410 (+212%)	-9 (-69%)	+3343 (+108%)	+2 (+15%)
M3	+82 (+8200%)	+11 (+138%)	Unused	-229 (-11%)	Unused	+604 (+56%)	Unused	Unused	Unused	+79 (+1975%)	+748 (+254%)	Unused	+1303 (+39%)	+5 (+45%)
M4	-95 (-66%)	-5 (-15%)	Unused	-8723 (-92%)	Unused	-561 (-31%)	Unused	Unused	Unused	+1 (New)	Unused	Unused	-9385 (-81%)	+3 (+50%)
M5	-35 (-47%)	-94 (-61%)	-1 (-100%)	-3429 (-78%)	Unused	+8 (+1%)	Unused	Unused	Unused	+21 (+210%)	+2 (New)	Unused	-3526 (-66%)	+0 (+0%)
M6	-3 (-100%)	+47 (+588%)	Unused	-3543 (-99%)	Unused	-360 (-65%)	Unused	Unused	-90 (-100%)	-7 (-78%)	+109 (+214%)	Unused	-3843 (-89%)	-5 (-42%)
Mowry Total	+156 (+70%)	+543 (+264%)	+383 (+38300%)	-13353 (-68%)	-9 (-90%)	-1247 (-16%)	Unused	-3 (-100%)	-90 (-100%)	+1190 (+447%)	+2196 (+131%)	-30 (-88%)	-10616 (-36%)	-3 (-12%)
R1	+184 (+256%)	+49 (+12%)	+129 (+58%)	-2 (-67%)	-92 (-85%)	+3 (+100%)	Unused	-39 (-76%)	Unused	-110 (-48%)	-16676 (-58%)	-70 (-73%)	-16740 (-57%)	-2 (-6%)
R2	-28 (-100%)	-393 (-100%)	Unused	Unused	Unused	+49 (+69%)	+1 (New)	-1 (-50%)	+12 (New)	-103 (-46%)	+13510 (+4262%)	-2 (-100%)	+13037 (+1246%)	+0 (+0%)
R3	+616 (New)	+285 (+648%)	Unused	+1 (+100%)	+2 (New)	Unused	Unused	+2 (New)	Unused	-135 (-36%)	-695 (-91%)	+13 (New)	+95 (+8%)	+6 (+40%)
R4	+7 (+117%)	-260 (-100%)	Unused	Unused	Unused	+29 (New)	Unused	+3 (New)	-15 (-100%)	-348 (-98%)	+781 (+34%)	+1 (New)	+194 (+7%)	-4 (-22%)
R5	-29 (-43%)	Unused	Unused	Unused	Unused	Unused	Unused	-5 (-62%)	Unused	-1 (-4%)	-6 (-100%)	-1 (-100%)	-27 (-22%)	-1 (-8%)
R5S	+7 (+23%)	Unused	Unused	Unused	Unused	Unused	Unused	-1 (-33%)	Unused	-8 (-14%)	-414 (-75%)	-1 (-100%)	-411 (-64%)	-3 (-20%)
RSF2U1	+154 (+93%)	+6 (+3%)	-8 (-9%)	-1 (-100%)	+0 (+0%)	-343 (-48%)	Unused	+4 (+400%)	Unused	+234 (+12%)	+1085 (+529%)	+162 (+149%)	+1299 (+38%)	+0 (+0%)
RSF2U2	-479 (-46%)	-430 (-61%)	-417 (-63%)	Unused	-1 (-33%)	+198 (+182%)	Unused	+0 (+0%)	Unused	+828 (+116%)	+619 (+257%)	-43 (-13%)	+700 (+22%)	+2 (+8%)
RSF2U3	+29 (+1450%)	+11 (+22%)	Unused	Unused	Unused	+57 (+570%)	Unused	-2 (-100%)	Unused	-45 (-45%)	-2711 (-68%)	Unused	-2658 (-64%)	+0 (+0%)
RSF2U4	-118 (-97%)	+119 (+25%)	+124 (+26%)	-3 (-100%)	+2 (New)	-1 (-100%)	Unused	-2 (-67%)	Unused	-79 (-99%)	-150 (-100%)	-2 (-50%)	-234 (-28%)	-9 (-47%)
Ravens-wood Total	+343 (+22%)	-613 (-24%)	-172 (-12%)	-5 (-62%)	-89 (-79%)	-8 (-1%)	+1 (New)	-41 (-56%)	-3 (-20%)	+233 (+6%)	-4657 (-13%)	+57 (+11%)	-4745 (-10%)	+2 (+5%)
All Areas Total	-9931 (-22%)	-29538 (-56%)	-20245 (-58%)	-14558 (-66%)	-436 (-16%)	-14107 (-32%)	+950 (+7308%)	+175 (+36%)	+1207 (+1050%)	-2135 (-11%)	-52197 (-37%)	+394 (+22%)	-120576 (-37%)	-6 (-9%)

Appendix 3

This appendix presents bars graphs (one per complex) of guild-specific waterbird abundance by survey round.

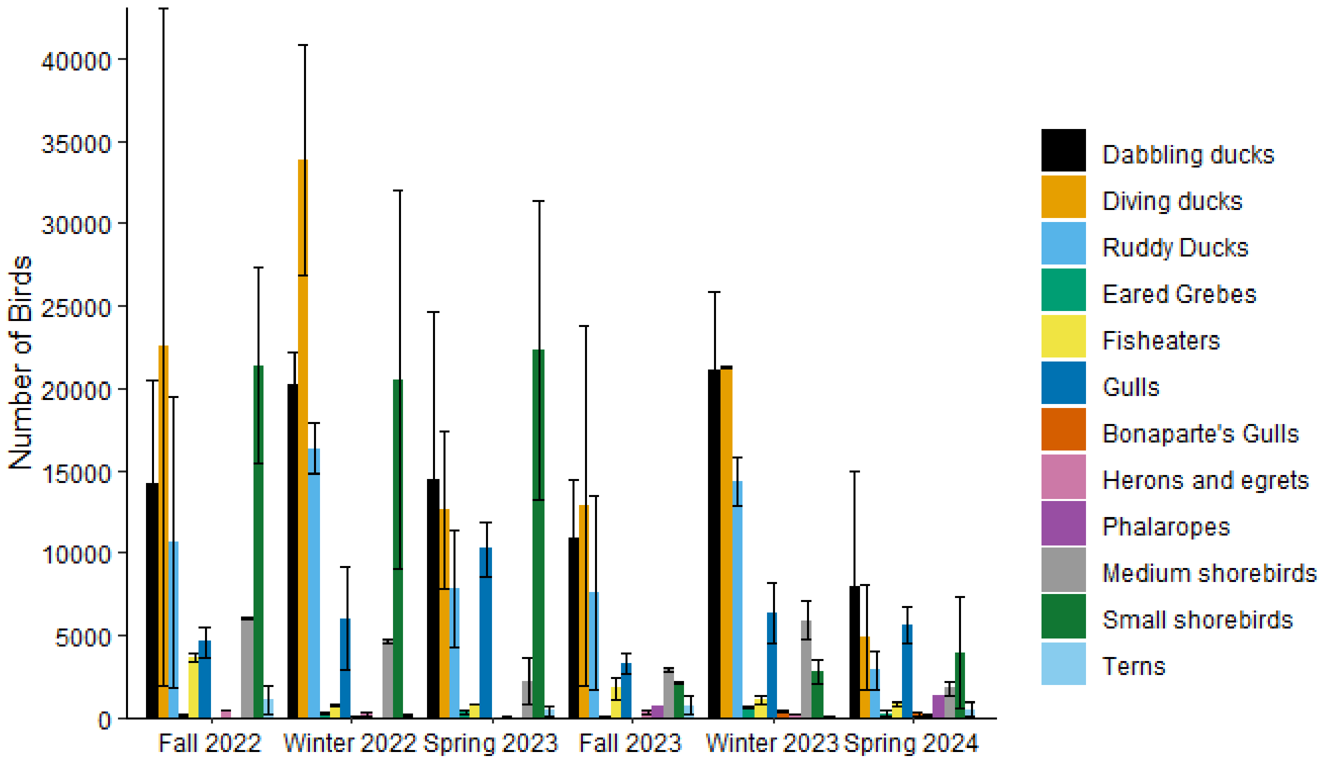


Figure A3.1. Avian abundance (mean number of bird sightings +/- 1 SE) by guild and by season at the Alviso complex, South San Francisco Bay, California; September 2023–May 2024. Scales on vertical axis are unique for each complex (Figure A3.1–Figure A3.6).

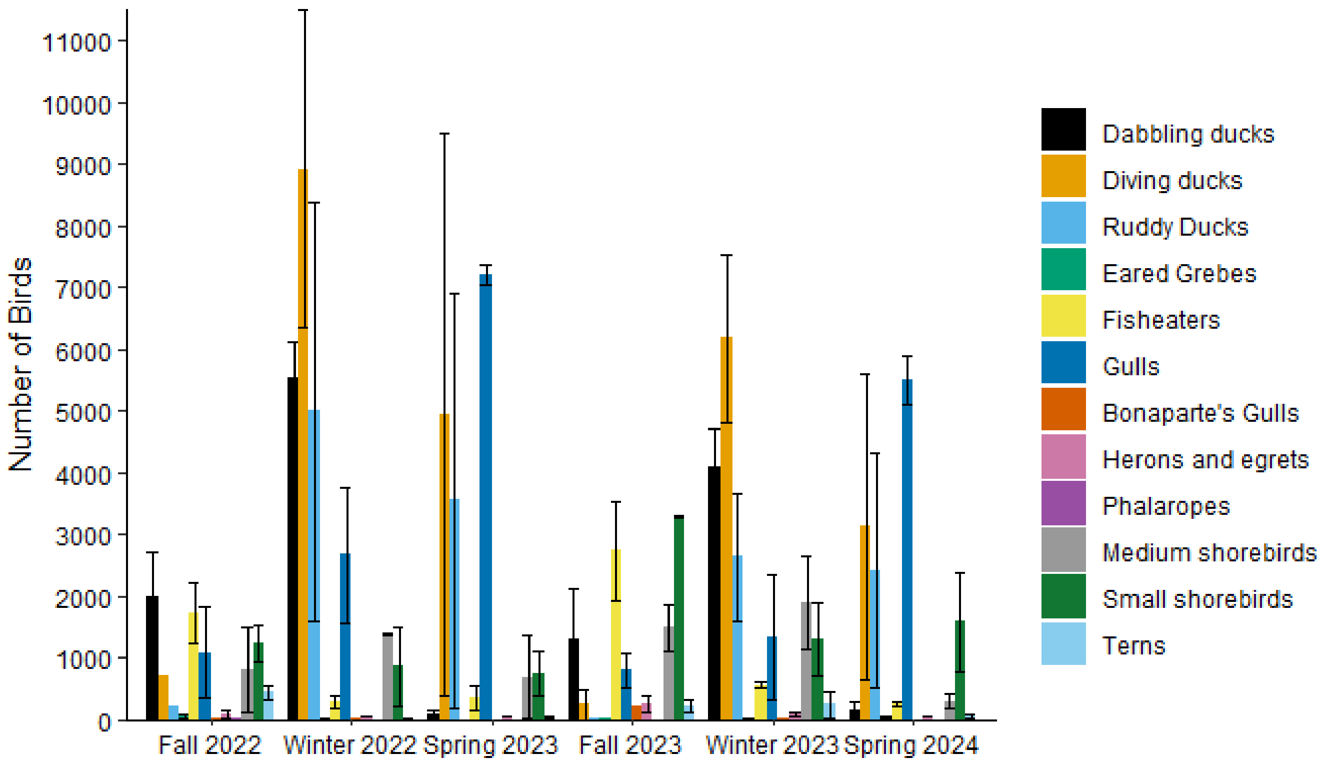


Figure A3.2. Avian abundance (mean number of bird sightings +/- 1 SE) by guild and by season at the Coyote Hills complex, South San Francisco Bay, California; September 2023–May 2024. Scales on vertical axis are unique for each complex (Figure A3.1–Figure A3.6).

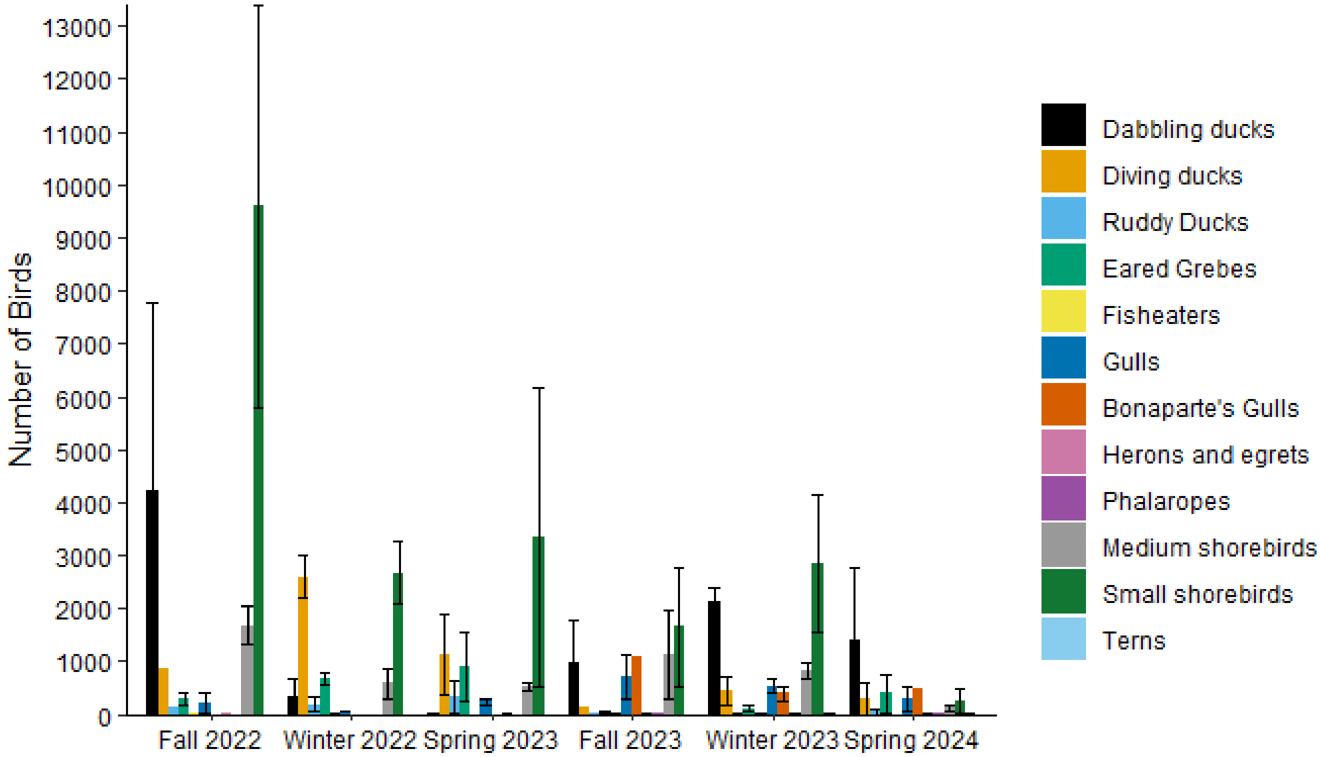


Figure A3.3. Avian abundance (mean number of bird sightings +/- 1 SE) by guild and by season at the Dumbarton complex, South San Francisco Bay, California; September 2023–May 2024. Scales on vertical axis are unique for each complex (Figure A3.1–Figure A3.6).

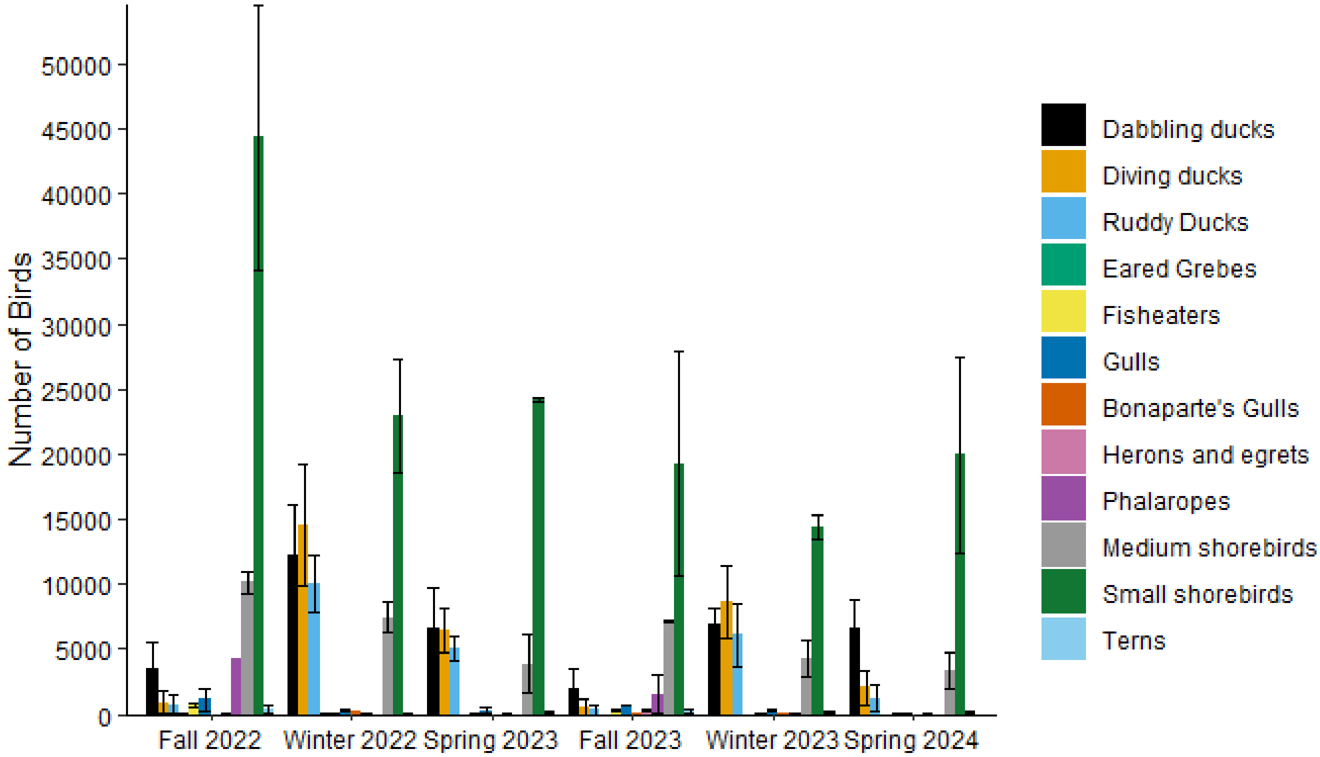


Figure A3.4. Avian abundance (mean number of bird sightings +/- 1 SE) by guild and by season at the Eden Landing complex, South San Francisco Bay, California; September 2023–May 2024. Scales on vertical axis are unique for each complex (Figure A3.1–Figure A3.6).

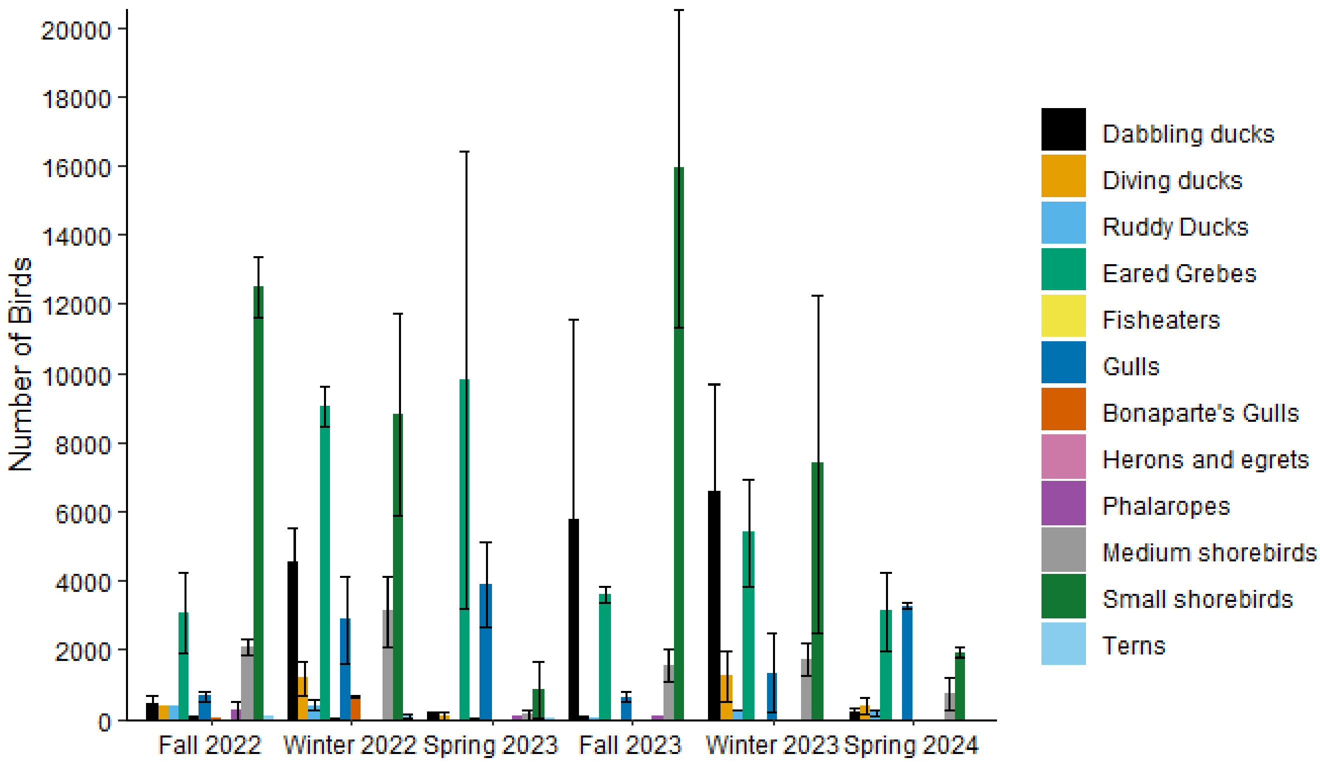


Figure A3.5. Avian abundance (mean number of bird sightings +/- 1 SE) by guild and by season at the Mowry complex, South San Francisco Bay, California; September 2023–May 2024. Scales on vertical axis are unique for each complex (Figure A3.1–Figure A3.6).

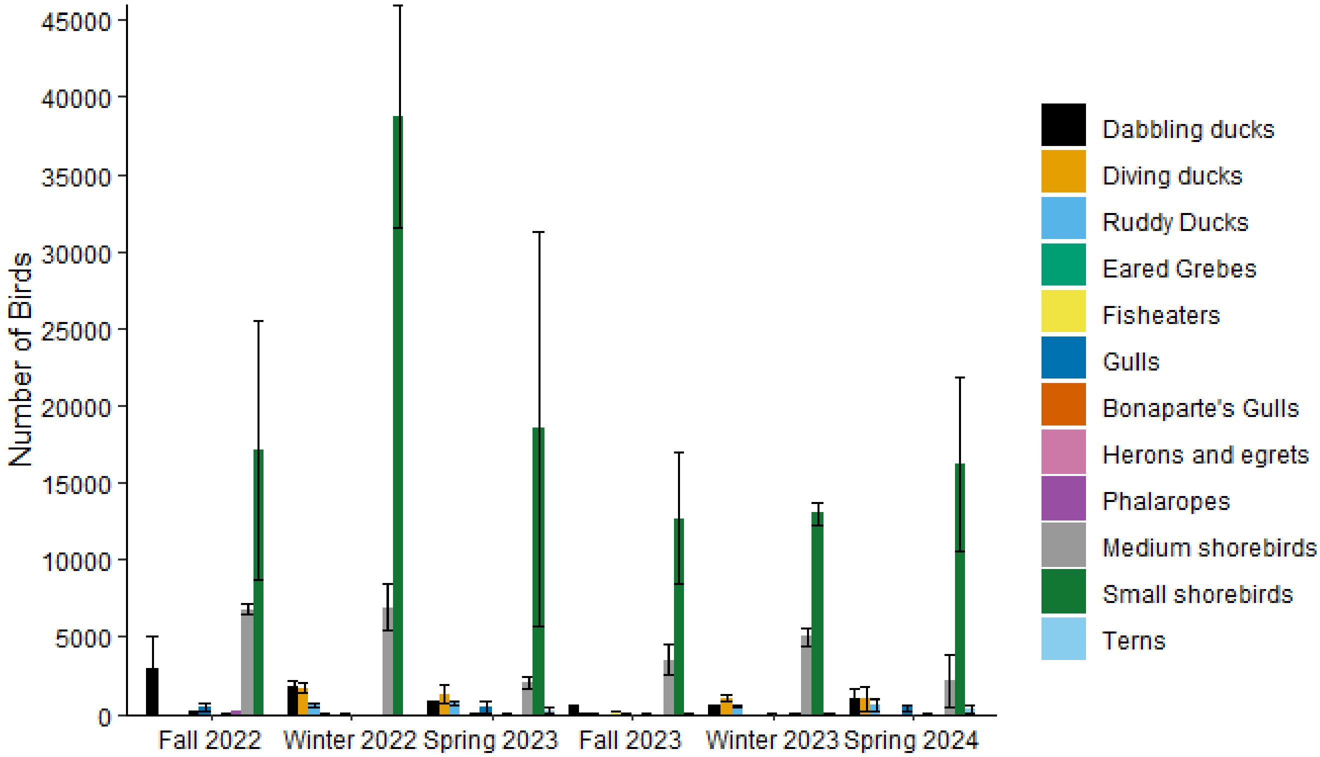


Figure A3.6. Avian abundance (mean number of bird sightings +/- 1 SE) by guild and by season at the Ravenswood complex, South San Francisco Bay, California; September 2023–May 2024. Scales on vertical axis are unique for each complex (Figure A3.1–Figure A3.6).

Appendix 4

This appendix presents tables (one per guild, plus total waterbird sightings) of the percent of bird sightings that were counted on each pond engaging in different behaviors: foraging, roosting on the pond surface, roosting on islands, roosting on levees, or roosting on manmade structures (e.g. blinds, fence posts).

Table A4.1. Percentage of total birds foraging, roosting, and using islands, levees, or manmade structures in each pond, South San Francisco Bay, California; September 2023 - May 2024. 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	24.7	73.2	0.0	0.5	1.7	13451
Alviso	A10	22.8	70.8	0.0	6.4	0.0	5004
Alviso	A11	21.7	66.3	2.1	10.0	0.0	4123
Alviso	A12	0.1	95.4	4.5	0.0	0.0	3962
Alviso	A13	57.6	41.9	0.0	0.5	0.0	5165
Alviso	A14	66.1	24.2	0.0	9.6	0.0	22158
Alviso	A15	54.2	44.7	0.0	1.1	0.0	4850
Alviso	A16	34.7	53.1	11.8	0.2	0.2	20694
Alviso	A17	51.0	48.9	0.0	0.1	0.0	5101
Alviso	A19	59.2	40.8	0.0	0.1	0.0	7892
Alviso	A22	44.8	54.8	0.0	0.3	0.1	4666
Alviso	A23	27.7	71.2	0.0	0.4	0.7	4462
Alviso	A2E	11.8	59.6	0.0	27.9	0.7	11154
Alviso	A2W	35.7	55.1	0.0	1.0	8.2	9801
Alviso	A3N	63.2	32.7	0.0	0.9	3.2	2882
Alviso	A3W	51.3	45.5	0.0	1.5	1.7	25438
Alviso	A5	49.2	31.0	0.0	15.1	4.6	14332
Alviso	A6S	57.8	40.7	0.0	1.4	0.1	727
Alviso	A7	39.5	32.0	0.2	28.3	0.0	14664
Alviso	A8	43.7	36.0	0.0	19.7	0.7	5511
Alviso	A8S	47.8	30.5	0.4	21.2	0.1	4160
Alviso	A8W	56.4	15.7	0.0	25.1	2.8	1877
Alviso	A9	48.0	50.4	0.0	1.5	0.1	23390
Alviso	AB1	21.2	74.2	3.6	0.3	0.7	12696
Alviso	AB2	43.7	30.3	5.9	19.4	0.7	14379
Coyote Hills	N1A	25.2	38.3	0.5	35.3	0.7	4140
Coyote Hills	N2A	22.6	53.5	0.1	23.7	0.0	10513
Coyote Hills	N3A	38.2	29.7	0.0	31.7	0.4	14728
Coyote Hills	N4	5.5	56.5	33.1	4.0	0.9	4332
Coyote Hills	N4AA	62.1	27.4	0.1	1.6	8.7	7566
Coyote Hills	N4AB	36.8	34.0	0.1	29.0	0.1	13067
Coyote Hills	N4B	71.8	26.4	0.0	0.3	1.5	3193
Coyote Hills	N5	21.2	40.6	0.0	31.6	6.6	770
Coyote Hills	N6	43.8	3.1	0.0	53.1	0.1	2991
Coyote Hills	N7	35.5	5.9	0.0	58.5	0.2	4778
Coyote Hills	N8	56.9	3.4	0.0	39.7	0.0	1938
Coyote Hills	N9	46.4	9.9	0.7	43.1	0.0	6603
Dumbarton	N1	64.6	26.9	5.7	0.5	2.2	11001
Dumbarton	N2	37.3	14.5	7.7	40.0	0.5	220

Complex	Pond	% Foraging	% Roosting	% Island	% Levee	% Manmade	N
Dumbarton	N3	5.6	4.4	27.0	61.1	1.8	2660
Dumbarton	NPP1	38.8	57.5	0.4	3.2	0.1	14792
Eden Landing	CP3C	57.3	40.9	0.0	0.2	1.6	14502
Eden Landing	E1	17.6	61.8	7.2	12.2	1.1	4571
Eden Landing	E10	26.4	70.0	2.0	0.3	1.3	7015
Eden Landing	E11	30.7	62.8	0.2	1.5	4.9	2052
Eden Landing	E12	49.3	34.2	1.2	13.4	1.9	14480
Eden Landing	E13	32.7	64.0	0.7	0.7	1.8	19018
Eden Landing	E14	84.4	15.6	0.0	0.0	0.0	18055
Eden Landing	E1C	88.5	11.3	0.1	0.1	0.0	2893
Eden Landing	E2	42.7	42.2	14.0	0.6	0.5	13854
Eden Landing	E2C	81.1	18.8	0.0	0.0	0.1	5416
Eden Landing	E4	50.5	48.2	0.2	0.7	0.4	5238
Eden Landing	E4C	40.0	54.4	0.0	0.0	5.6	14981
Eden Landing	E5	61.1	36.4	0.0	0.0	2.6	5005
Eden Landing	E5C	51.7	48.1	0.0	0.0	0.2	7098
Eden Landing	E6	38.9	58.9	0.1	0.0	2.1	3238
Eden Landing	E6A	34.0	65.2	0.5	0.0	0.2	15664
Eden Landing	E6B	63.1	36.8	0.0	0.0	0.1	15236
Eden Landing	E6C	69.0	30.1	0.0	0.3	0.6	4037
Eden Landing	E7	32.5	46.6	0.2	0.2	20.5	6471
Eden Landing	E8	20.2	74.0	0.1	0.0	5.6	6887
Eden Landing	E8AE	63.2	36.8	0.0	0.0	0.0	1432
Eden Landing	E8AW	18.2	81.7	0.0	0.1	0.1	1644
Eden Landing	E8XN	21.6	77.9	0.0	0.3	0.3	705
Eden Landing	E8XS	67.9	29.2	0.0	2.8	0.0	106
Eden Landing	E9	49.4	49.9	0.1	0.4	0.2	9441
Mowry	M1	23.0	20.8	1.1	55.1	0.0	27067
Mowry	M2	24.2	30.7	10.9	34.3	0.0	39410
Mowry	M3	53.1	12.3	28.9	5.6	0.0	27611
Mowry	M4	54.4	23.9	0.0	21.6	0.0	9900
Mowry	M5	31.3	53.8	0.3	14.6	0.0	10423
Mowry	M6	44.8	52.6	0.3	2.3	0.0	7484
Ravenswood	R1	53.9	46.1	0.0	0.0	0.0	54519
Ravenswood	R2	37.1	62.9	0.0	0.0	0.0	20300
Ravenswood	R3	73.3	21.9	0.4	4.3	0.0	1559
Ravenswood	R4	30.3	69.4	0.0	0.4	0.0	6752
Ravenswood	R5	40.7	57.0	0.0	2.3	0.0	697
Ravenswood	R5S	59.2	33.4	0.0	7.3	0.0	287
Ravenswood	RSF2U1	22.0	64.5	9.4	3.1	1.0	17298
Ravenswood	RSF2U2	12.0	35.5	38.8	13.4	0.3	10947
Ravenswood	RSF2U3	42.6	57.3	0.1	0.1	0.0	1971
Ravenswood	RSF2U4	23.9	74.7	0.0	1.4	0.0	1731

Table A4.2. Percentage of dabbling ducks foraging, roosting, and using islands, levees, or manmade structures in each pond, South San Francisco Bay, California; September 2023 - May 2024. 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	78.0	19.9	0.0	1.5	0.5	1887
Alviso	A10	48.3	31.8	0.2	19.7	0.0	487
Alviso	A11	42.6	52.1	0.0	5.3	0.0	94
Alviso	A12	100.0	0.0	0.0	0.0	0.0	1
Alviso	A13	100.0	0.0	0.0	0.0	0.0	34
Alviso	A14	74.8	22.8	0.0	2.3	0.0	15541
Alviso	A15	0.0	100.0	0.0	0.0	0.0	2
Alviso	A16	40.7	57.8	1.5	0.0	0.0	14628
Alviso	A17	63.3	36.6	0.0	0.1	0.0	2933
Alviso	A19	88.1	11.9	0.0	0.0	0.0	3944
Alviso	A22	85.3	14.7	0.0	0.0	0.0	116
Alviso	A2E	33.7	48.5	0.0	17.8	0.0	202
Alviso	A2W	31.7	64.1	0.0	3.4	0.7	145
Alviso	A3N	90.6	6.0	0.0	2.0	1.3	149
Alviso	A3W	86.9	10.2	0.0	2.5	0.4	8939
Alviso	A5	70.1	5.6	0.0	24.3	0.0	2364
Alviso	A6S	59.7	40.3	0.0	0.0	0.0	591
Alviso	A7	59.0	30.7	0.0	10.3	0.0	7353
Alviso	A8	80.8	18.2	0.0	0.4	0.6	676
Alviso	A8S	76.6	14.8	0.0	8.5	0.0	411
Alviso	A8W	86.6	5.1	0.0	5.4	2.9	789
Alviso	A9	75.4	24.5	0.0	0.0	0.0	8451
Alviso	AB1	68.4	24.3	6.9	0.4	0.0	2473
Alviso	AB2	63.8	22.6	5.7	7.8	0.0	7621
Coyote Hills	N1A	72.2	27.8	0.0	0.0	0.0	609
Coyote Hills	N2A	50.1	49.7	0.0	0.2	0.0	925
Coyote Hills	N3A	40.5	54.0	0.0	5.4	0.0	2149
Coyote Hills	N4AA	50.9	47.0	0.0	1.0	1.2	1211
Coyote Hills	N4AB	65.4	34.6	0.0	0.0	0.0	5265
Coyote Hills	N4B	60.1	39.5	0.0	0.0	0.4	552
Coyote Hills	N5	5.1	83.7	0.0	11.2	0.0	98
Coyote Hills	N6	75.0	25.0	0.0	0.0	0.0	16
Coyote Hills	N7	74.2	25.8	0.0	0.0	0.0	93
Coyote Hills	N8	60.7	39.3	0.0	0.0	0.0	28
Coyote Hills	N9	94.9	4.4	0.0	0.6	0.0	158
Dumbarton	N1	53.0	36.9	9.4	0.6	0.0	5327
Dumbarton	N2	5.4	8.1	0.0	86.5	0.0	37
Dumbarton	N3	86.2	6.9	0.0	6.9	0.0	29
Dumbarton	NPP1	72.5	14.6	0.9	12.1	0.0	3632

Complex	Pond	% Foraging	% Roosting	% Island	% Levee	% Manmade	N
Eden Landing	CP3C	38.4	61.2	0.0	0.4	0.0	3022
Eden Landing	E1	55.6	33.3	11.1	0.0	0.0	36
Eden Landing	E10	53.5	46.5	0.0	0.0	0.0	1128
Eden Landing	E11	64.7	35.3	0.0	0.0	0.0	184
Eden Landing	E12	72.9	12.9	2.2	11.9	0.0	3337
Eden Landing	E13	56.7	37.0	2.9	3.4	0.0	889
Eden Landing	E14	69.8	30.2	0.0	0.0	0.0	43
Eden Landing	E1C	61.2	38.8	0.0	0.0	0.0	278
Eden Landing	E2	60.6	38.2	0.2	0.9	0.0	1300
Eden Landing	E2C	63.2	36.8	0.0	0.0	0.0	641
Eden Landing	E4	75.2	22.0	0.9	1.9	0.0	1411
Eden Landing	E4C	65.1	34.9	0.0	0.0	0.0	252
Eden Landing	E5	68.6	31.4	0.0	0.0	0.0	2064
Eden Landing	E5C	64.3	35.7	0.0	0.0	0.0	1309
Eden Landing	E6	75.5	23.0	0.4	0.2	0.9	457
Eden Landing	E6A	53.8	46.0	0.0	0.1	0.1	2944
Eden Landing	E6B	54.6	45.1	0.0	0.3	0.0	689
Eden Landing	E6C	74.5	25.1	0.0	0.4	0.0	1575
Eden Landing	E7	34.7	65.0	0.1	0.2	0.0	4047
Eden Landing	E8	44.6	55.4	0.0	0.0	0.0	1466
Eden Landing	E8AE	87.5	12.5	0.0	0.0	0.0	48
Eden Landing	E8AW	71.3	28.7	0.0	0.0	0.0	380
Eden Landing	E8XN	35.0	65.0	0.0	0.0	0.0	20
Eden Landing	E8XS	43.8	56.2	0.0	0.0	0.0	48
Eden Landing	E9	30.3	69.6	0.0	0.0	0.0	3078
Mowry	M1	45.6	30.5	7.9	16.0	0.0	3489
Mowry	M2	30.7	54.2	4.7	10.5	0.0	16120
Mowry	M3	75.8	13.3	5.6	5.3	0.0	3598
Mowry	M4	65.9	19.3	0.0	14.8	0.0	1645
Mowry	M5	58.9	41.1	0.0	0.0	0.0	282
Mowry	M6	60.0	40.0	0.0	0.0	0.0	5
Ravenswood	R1	38.5	61.5	0.0	0.0	0.0	392
Ravenswood	R2	30.8	69.2	0.0	0.0	0.0	13
Ravenswood	R3	91.1	7.3	0.8	0.8	0.0	616
Ravenswood	R4	7.7	92.3	0.0	0.0	0.0	13
Ravenswood	R5	36.2	63.8	0.0	0.0	0.0	47
Ravenswood	R5S	8.9	60.0	0.0	31.1	0.0	45
Ravenswood	RSF2U1	63.5	28.7	5.4	2.4	0.0	1270
Ravenswood	RSF2U2	52.0	12.9	31.2	3.8	0.1	1397
Ravenswood	RSF2U3	3.1	96.9	0.0	0.0	0.0	32
Ravenswood	RSF2U4	15.6	84.4	0.0	0.0	0.0	32

Table A4.3. Percentage of diving ducks foraging, roosting, and using islands, levees, or manmade structures in each pond, South San Francisco Bay, California; September 2023 - May 2024. 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	14.6	85.4	0.0	0.0	0.0	10731
Alviso	A10	16.2	83.5	0.0	0.3	0.0	3928
Alviso	A11	21.4	78.6	0.0	0.0	0.0	3349
Alviso	A13	100.0	0.0	0.0	0.0	0.0	250
Alviso	A14	59.7	40.3	0.0	0.0	0.0	3763
Alviso	A16	32.5	67.3	0.2	0.0	0.0	1696
Alviso	A17	10.6	89.4	0.0	0.0	0.0	435
Alviso	A19	87.0	13.0	0.0	0.0	0.0	92
Alviso	A22	80.8	19.2	0.0	0.0	0.0	26
Alviso	A2E	12.7	87.2	0.0	0.0	0.0	7380
Alviso	A2W	38.0	61.8	0.0	0.2	0.0	8380
Alviso	A3N	58.5	41.5	0.0	0.0	0.0	480
Alviso	A3W	29.7	70.2	0.0	0.0	0.0	15098
Alviso	A5	43.6	56.2	0.0	0.2	0.0	6993
Alviso	A6S	86.0	14.0	0.0	0.0	0.0	43
Alviso	A7	21.9	77.7	0.0	0.5	0.0	2882
Alviso	A8	37.9	62.0	0.0	0.0	0.0	2020
Alviso	A8S	60.5	39.4	0.0	0.1	0.0	1554
Alviso	A8W	41.2	58.8	0.0	0.0	0.0	148
Alviso	A9	36.0	64.0	0.0	0.0	0.0	3060
Alviso	AB1	10.1	89.8	0.0	0.0	0.1	4406
Alviso	AB2	10.3	89.5	0.0	0.1	0.1	1334
Coyote Hills	N1A	13.7	86.3	0.0	0.0	0.0	1455
Coyote Hills	N2A	25.2	74.7	0.0	0.0	0.0	6638
Coyote Hills	N3A	43.6	56.4	0.0	0.0	0.0	2314
Coyote Hills	N4	8.7	91.3	0.0	0.0	0.0	207
Coyote Hills	N4AA	53.4	46.6	0.0	0.0	0.0	2371
Coyote Hills	N4AB	11.2	88.8	0.0	0.0	0.0	2729
Coyote Hills	N4B	50.2	49.8	0.0	0.0	0.0	410
Coyote Hills	N5	23.5	76.5	0.0	0.0	0.0	149
Coyote Hills	N6	85.0	15.0	0.0	0.0	0.0	314
Coyote Hills	N7	78.1	21.9	0.0	0.0	0.0	1091
Coyote Hills	N8	95.5	4.5	0.0	0.0	0.0	357
Coyote Hills	N9	70.8	29.2	0.0	0.0	0.0	1035
Dumbarton	N1	92.4	7.6	0.0	0.0	0.0	1306
Dumbarton	N2	100.0	0.0	0.0	0.0	0.0	36
Dumbarton	N3	56.7	43.3	0.0	0.0	0.0	67
Dumbarton	NPP1	51.1	48.9	0.0	0.0	0.0	223
Eden Landing	CP3C	9.7	90.3	0.0	0.0	0.0	1156

Complex	Pond	% Foraging	% Roosting	% Island	% Levee	% Manmade	N
Eden Landing	E1	20.1	79.9	0.0	0.0	0.0	3169
Eden Landing	E10	17.3	82.7	0.0	0.0	0.0	3377
Eden Landing	E11	38.8	61.2	0.0	0.0	0.0	430
Eden Landing	E12	71.0	28.6	0.0	0.4	0.0	803
Eden Landing	E13	95.4	4.6	0.0	0.0	0.0	413
Eden Landing	E1C	75.4	24.6	0.0	0.0	0.0	126
Eden Landing	E2	43.8	56.2	0.0	0.0	0.0	3458
Eden Landing	E2C	75.0	25.0	0.0	0.0	0.0	4
Eden Landing	E4	94.5	5.5	0.0	0.0	0.0	272
Eden Landing	E4C	81.8	18.2	0.0	0.0	0.0	358
Eden Landing	E5	36.6	63.4	0.0	0.0	0.0	82
Eden Landing	E5C	100.0	0.0	0.0	0.0	0.0	97
Eden Landing	E6	6.1	93.9	0.0	0.0	0.0	280
Eden Landing	E6A	28.3	71.7	0.0	0.0	0.0	4681
Eden Landing	E6B	24.8	75.2	0.0	0.0	0.0	1976
Eden Landing	E6C	63.2	36.8	0.0	0.0	0.0	87
Eden Landing	E7	67.9	32.1	0.0	0.0	0.0	560
Eden Landing	E8	84.6	15.4	0.0	0.0	0.0	369
Eden Landing	E8AE	96.7	3.3	0.0	0.0	0.0	30
Eden Landing	E8AW	93.8	6.2	0.0	0.0	0.0	16
Eden Landing	E8XN	19.3	80.7	0.0	0.0	0.0	659
Eden Landing	E8XS	0.0	100.0	0.0	0.0	0.0	2
Eden Landing	E9	27.4	72.6	0.0	0.0	0.0	157
Mowry	M1	17.1	82.9	0.0	0.0	0.0	665
Mowry	M2	59.7	40.3	0.0	0.0	0.0	836
Mowry	M3	39.8	60.2	0.0	0.0	0.0	465
Mowry	M4	82.4	17.0	0.0	0.5	0.0	370
Mowry	M5	36.7	63.3	0.0	0.0	0.0	98
Mowry	M6	15.0	85.0	0.0	0.0	0.0	882
Ravenswood	R1	12.7	87.3	0.0	0.0	0.0	895
Ravenswood	R2	80.6	19.4	0.0	0.0	0.0	175
Ravenswood	R3	76.0	24.0	0.0	0.0	0.0	334
Ravenswood	R5	100.0	0.0	0.0	0.0	0.0	1
Ravenswood	R5S	100.0	0.0	0.0	0.0	0.0	8
Ravenswood	RSF2U1	55.9	44.1	0.0	0.0	0.0	642
Ravenswood	RSF2U2	39.4	59.1	1.4	0.0	0.0	345
Ravenswood	RSF2U3	82.3	17.7	0.0	0.0	0.0	130
Ravenswood	RSF2U4	22.6	77.4	0.0	0.0	0.0	1603

Table A4.5. Percentage of Eared Grebes foraging, roosting, and using islands, levees, or manmade structures in each pond, South San Francisco Bay, California; September 2023 - May 2024. 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	77.1	22.9	0	0	0	35
Alviso	A10	66.7	33.3	0	0	0	51
Alviso	A11	100.0	0.0	0	0	0	7
Alviso	A13	100.0	0.0	0	0	0	3
Alviso	A14	82.4	17.6	0	0	0	346
Alviso	A16	92.3	7.7	0	0	0	39
Alviso	A2E	43.0	57.0	0	0	0	79
Alviso	A2W	84.8	15.2	0	0	0	33
Alviso	A3W	100.0	0.0	0	0	0	175
Alviso	A5	95.1	4.9	0	0	0	164
Alviso	A7	100.0	0.0	0	0	0	27
Alviso	A8	100.0	0.0	0	0	0	546
Alviso	A8S	87.6	12.4	0	0	0	338
Alviso	A8W	100.0	0.0	0	0	0	58
Alviso	A9	100.0	0.0	0	0	0	4
Alviso	AB2	100.0	0.0	0	0	0	6
Coyote Hills	N2A	32.7	67.3	0	0	0	49
Coyote Hills	N3A	100.0	0.0	0	0	0	1
Coyote Hills	N4AA	25.0	75.0	0	0	0	4
Coyote Hills	N4AB	91.3	8.7	0	0	0	46
Coyote Hills	N4B	100.0	0.0	0	0	0	1
Coyote Hills	N7	100.0	0.0	0	0	0	13
Dumbarton	N1	83.1	16.9	0	0	0	338
Dumbarton	N2	100.0	0.0	0	0	0	16
Dumbarton	N3	100.0	0.0	0	0	0	7
Dumbarton	NPP1	27.4	72.6	0	0	0	720
Eden Landing	CP3C	100.0	0.0	0	0	0	1
Eden Landing	E12	66.7	33.3	0	0	0	3
Eden Landing	E13	100.0	0.0	0	0	0	2
Eden Landing	E2	100.0	0.0	0	0	0	1
Eden Landing	E5	66.7	33.3	0	0	0	3
Eden Landing	E6	71.4	28.6	0	0	0	7
Eden Landing	E6A	87.5	12.5	0	0	0	8
Eden Landing	E6C	100.0	0.0	0	0	0	2
Mowry	M1	66.5	33.5	0	0	0	4885
Mowry	M2	77.5	22.5	0	0	0	4546
Mowry	M3	80.9	19.1	0	0	0	8519
Mowry	M4	67.2	32.8	0	0	0	4789
Mowry	M5	68.5	31.5	0	0	0	1382

Complex	Pond	% Foraging	% Roosting	% Island	% Levee	% Manmade	N
Mowry	M6	86.0	14.0	0	0	0	50
Ravenswood	R1	100.0	0.0	0	0	0	2
Ravenswood	R3	100.0	0.0	0	0	0	2
Ravenswood	RSF2U1	50.0	50.0	0	0	0	2

Table A4.6. Percentage of fisheaters foraging, roosting, and using islands, levees, or manmade structures in each pond, South San Francisco Bay, California; September 2023 - May 2024. N is the total number of bird sightings during the study period. Only ponds with one or more sightings are shown. Pond CP3C is in the Eden Landing area but owned by Cargill.

Complex	Pond	% Foraging	% Roosting	% Island	% Levee	% Manmade	N
Alviso	A1	41.0	21.9	0.0	0.3	36.9	366
Alviso	A10	55.8	16.9	0.0	27.3	0.0	337
Alviso	A11	16.1	16.1	0.0	67.9	0.0	224
Alviso	A13	0.0	0.0	0.0	100.0	0.0	5
Alviso	A14	18.8	20.1	0.0	61.1	0.0	830
Alviso	A16	23.6	8.7	65.8	0.0	1.9	897
Alviso	A17	100.0	0.0	0.0	0.0	0.0	5
Alviso	A2E	48.1	25.0	0.0	15.4	11.5	52
Alviso	A2W	22.5	13.3	0.0	0.0	64.2	653
Alviso	A3N	0.0	0.0	0.0	86.7	13.3	15
Alviso	A3W	48.2	4.7	0.0	10.5	36.6	612
Alviso	A5	17.1	5.5	0.0	77.5	0.0	1173
Alviso	A7	17.7	3.5	0.0	78.9	0.0	606
Alviso	A8	28.0	17.1	0.0	49.9	5.0	543
Alviso	A8S	49.6	20.9	5.0	23.3	1.2	258
Alviso	A8W	15.7	6.3	0.0	64.8	13.2	159
Alviso	A9	0.9	0.0	0.0	99.1	0.0	320
Alviso	AB1	51.6	2.2	0.0	1.1	45.2	93
Alviso	AB2	10.1	44.1	21.8	14.9	9.0	188
Coyote Hills	N1A	45.6	16.4	4.6	29.6	3.7	432
Coyote Hills	N2A	19.2	7.8	0.0	72.9	0.2	579
Coyote Hills	N3A	53.1	0.7	0.0	44.9	1.3	1575
Coyote Hills	N4	38.5	9.2	0.0	6.2	46.2	65
Coyote Hills	N4AA	78.5	9.9	1.4	9.6	0.5	553
Coyote Hills	N4AB	27.7	0.7	0.0	71.4	0.1	2678
Coyote Hills	N4B	100.0	0.0	0.0	0.0	0.0	1
Coyote Hills	N5	13.5	56.2	0.0	15.7	14.6	178
Coyote Hills	N6	68.6	0.0	0.0	31.4	0.0	118
Coyote Hills	N7	32.4	5.9	0.0	57.6	4.1	170
Coyote Hills	N8	80.0	16.0	0.0	4.0	0.0	75
Coyote Hills	N9	47.3	0.9	0.0	51.8	0.0	677
Dumbarton	N1	12.5	0.0	0.0	0.0	87.5	8
Dumbarton	N2	50.0	0.0	0.0	50.0	0.0	4
Dumbarton	N3	19.0	19.0	0.0	0.0	61.9	42
Dumbarton	NPP1	100.0	0.0	0.0	0.0	0.0	2
Eden Landing	CP3C	56.8	0.0	0.0	10.8	32.4	37
Eden Landing	E1	10.0	1.9	54.5	22.6	11.0	319
Eden Landing	E10	60.9	35.8	2.0	0.0	1.3	151
Eden Landing	E11	10.5	68.4	0.0	0.0	21.1	38

Complex	Pond	% Foraging	% Roosting	% Island	% Levee	% Manmade	N
Eden Landing	E12	35.0	8.0	5.0	52.0	0.0	100
Eden Landing	E13	25.0	0.0	50.0	25.0	0.0	4
Eden Landing	E2	75.6	4.5	8.6	4.1	7.2	221
Eden Landing	E4	94.1	0.0	0.0	5.9	0.0	17
Eden Landing	E4C	0.0	0.0	0.0	0.0	100.0	1
Eden Landing	E6A	38.1	42.9	0.0	0.0	19.0	63
Eden Landing	E6B	100.0	0.0	0.0	0.0	0.0	1
Eden Landing	E7	16.0	12.3	0.0	0.0	71.6	81
Eden Landing	E8AE	100.0	0.0	0.0	0.0	0.0	1
Eden Landing	E8AW	100.0	0.0	0.0	0.0	0.0	2
Eden Landing	E8XN	71.4	28.6	0.0	0.0	0.0	7
Eden Landing	E9	50.0	11.1	0.0	5.6	33.3	18
Mowry	M1	0.0	0.0	0.0	83.3	16.7	6
Mowry	M2	0.0	0.0	0.0	50.0	50.0	2
Ravenswood	R1	27.5	72.5	0.0	0.0	0.0	222
Ravenswood	R3	0.0	100.0	0.0	0.0	0.0	2
Ravenswood	R4	100.0	0.0	0.0	0.0	0.0	1
Ravenswood	RSF2U1	21.2	0.0	0.0	69.2	9.6	52
Ravenswood	RSF2U2	60.0	14.7	16.7	6.7	2.0	150
Ravenswood	RSF2U3	0.0	100.0	0.0	0.0	0.0	1
Ravenswood	RSF2U4	100.0	0.0	0.0	0.0	0.0	25

Table A4.7. Percentage of gulls foraging, roosting, and using islands, levees, or manmade structures in each pond, South San Francisco Bay, California; September 2023 - May 2024. N is the total number of bird sightings during the study period. Only ponds with one or more sightings are shown. Pond CP3C is in the Eden Landing area but owned by Cargill.

Complex	Pond	% Foraging	% Roosting	% Island	% Levee	% Manmade	N
Alviso	A1	0.8	80.4	0.0	0.0	18.8	245
Alviso	A10	1.9	26.9	0.0	71.2	0.0	52
Alviso	A11	12.3	8.8	1.8	77.2	0.0	57
Alviso	A12	0.1	95.5	4.5	0.0	0.0	3957
Alviso	A13	11.8	86.9	0.0	1.3	0.0	1038
Alviso	A14	45.7	9.8	0.0	44.3	0.2	488
Alviso	A15	0.7	92.8	0.0	6.5	0.0	765
Alviso	A16	0.1	8.3	90.2	0.0	1.4	1108
Alviso	A17	1.0	99.0	0.0	0.0	0.0	925
Alviso	A19	17.1	82.9	0.0	0.0	0.0	3008
Alviso	A22	0.5	98.9	0.0	0.6	0.0	1340
Alviso	A23	18.1	79.9	0.0	0.7	1.3	2483
Alviso	A2E	5.6	1.2	0.0	92.3	0.9	3292
Alviso	A2W	0.4	3.7	0.0	1.5	94.5	273
Alviso	A3N	0.0	20.0	0.0	20.0	60.0	5
Alviso	A3W	39.5	3.3	0.0	15.7	41.5	306
Alviso	A5	50.3	3.7	0.2	17.1	28.7	2288
Alviso	A6S	0.0	0.0	0.0	0.0	100.0	1
Alviso	A7	8.2	4.3	0.6	86.7	0.1	2935
Alviso	A8	22.7	26.6	0.0	50.5	0.2	1332
Alviso	A8S	16.2	32.2	0.2	51.3	0.2	1238
Alviso	A8W	39.8	28.0	0.0	32.1	0.0	507
Alviso	A9	2.2	93.9	0.0	3.3	0.6	181
Alviso	AB1	0.0	49.4	0.0	22.8	27.8	79
Alviso	AB2	0.3	0.7	14.1	82.6	2.5	2604
Coyote Hills	N1A	2.6	6.8	0.0	86.9	3.7	191
Coyote Hills	N2A	1.7	6.7	0.1	91.5	0.0	1719
Coyote Hills	N3A	11.1	0.2	0.0	88.6	0.0	3786
Coyote Hills	N4	0.3	65.3	0.0	33.7	0.6	329
Coyote Hills	N4AA	10.4	17.4	0.0	19.9	52.2	201
Coyote Hills	N4AB	0.5	8.5	0.0	91.0	0.0	1973
Coyote Hills	N4B	50.0	0.0	0.0	50.0	0.0	2
Coyote Hills	N5	0.0	2.5	0.0	97.5	0.0	80
Coyote Hills	N6	3.2	0.1	0.0	96.7	0.0	1603
Coyote Hills	N7	0.0	0.0	0.0	99.9	0.0	2457
Coyote Hills	N8	0.0	1.8	0.0	98.2	0.0	337
Coyote Hills	N9	1.1	5.0	0.1	93.8	0.0	2585
Dumbarton	N1	89.2	6.3	1.2	0.2	3.1	2430
Dumbarton	N2	0.0	0.0	52.4	47.6	0.0	21

Complex	Pond	% Foraging	% Roosting	% Island	% Levee	% Manmade	N
Dumbarton	N3	1.4	39.7	9.6	34.2	15.1	73
Dumbarton	NPP1	77.8	22.0	0.0	0.2	0.0	572
Eden Landing	CP3C	2.7	96.9	0.0	0.0	0.4	819
Eden Landing	E1	0.6	71.2	3.8	22.4	1.9	156
Eden Landing	E10	6.7	88.3	0.0	0.0	5.0	60
Eden Landing	E11	0.0	100.0	0.0	0.0	0.0	5
Eden Landing	E12	11.2	70.8	7.5	9.3	1.2	161
Eden Landing	E13	5.3	94.7	0.0	0.0	0.0	75
Eden Landing	E14	0.0	100.0	0.0	0.0	0.0	1
Eden Landing	E2	19.1	40.4	37.1	0.0	3.4	89
Eden Landing	E2C	16.7	83.3	0.0	0.0	0.0	6
Eden Landing	E4	0.0	98.0	0.0	2.0	0.0	49
Eden Landing	E4C	86.1	13.9	0.0	0.0	0.0	144
Eden Landing	E5	6.2	93.8	0.0	0.0	0.0	227
Eden Landing	E5C	100.0	0.0	0.0	0.0	0.0	3
Eden Landing	E6	0.0	44.4	0.0	0.0	55.6	90
Eden Landing	E6A	3.4	51.9	39.9	0.0	4.8	208
Eden Landing	E6B	30.3	66.7	0.0	0.0	3.0	33
Eden Landing	E6C	82.6	0.0	0.0	0.0	17.4	46
Eden Landing	E7	5.6	11.1	0.0	5.6	77.8	18
Eden Landing	E8	0.0	50.0	0.0	0.0	50.0	2
Eden Landing	E8AE	0.0	100.0	0.0	0.0	0.0	1
Eden Landing	E8AW	0.0	75.0	0.0	0.0	25.0	4
Eden Landing	E9	0.0	20.0	0.0	0.0	80.0	5
Mowry	M1	5.4	0.0	0.0	94.6	0.0	1918
Mowry	M2	2.5	1.8	13.9	81.7	0.0	2090
Mowry	M3	66.7	0.7	4.8	27.7	0.1	1901
Mowry	M4	18.4	7.7	0.0	73.8	0.0	2420
Mowry	M5	12.2	3.8	0.0	84.0	0.0	1807
Mowry	M6	7.9	43.3	5.8	42.2	0.8	365
Ravenswood	R1	17.9	82.1	0.0	0.0	0.0	28
Ravenswood	R2	98.4	1.6	0.0	0.0	0.0	124
Ravenswood	R4	0.0	100.0	0.0	0.0	0.0	29
Ravenswood	RSF2U1	1.1	6.9	70.2	11.5	10.3	436
Ravenswood	RSF2U2	0.3	5.2	77.5	16.8	0.3	387
Ravenswood	RSF2U3	4.1	95.9	0.0	0.0	0.0	73

Table A4.9. Percentage of herons and egrets foraging, roosting, and using islands, levees, or manmade structures in each pond, South San Francisco Bay, California; September 2023 - May 2024. 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	43.0	20.3	0.0	32.9	3.8	79
Alviso	A10	31.2	3.1	0.0	62.5	3.1	32
Alviso	A11	28.6	28.6	0.0	42.9	0.0	14
Alviso	A14	48.6	2.7	0.0	32.4	16.2	37
Alviso	A16	86.6	1.7	10.0	1.3	0.3	299
Alviso	A17	40.0	60.0	0.0	0.0	0.0	20
Alviso	A19	66.7	33.3	0.0	0.0	0.0	6
Alviso	A22	50.0	0.0	0.0	50.0	0.0	2
Alviso	A2E	39.6	5.7	0.0	45.3	9.4	53
Alviso	A2W	31.0	9.5	0.0	41.7	17.9	84
Alviso	A3N	17.5	19.0	0.0	6.3	57.1	63
Alviso	A3W	73.8	12.6	0.0	6.8	6.8	103
Alviso	A5	65.6	3.1	0.0	23.4	7.8	64
Alviso	A6S	33.3	25.0	0.0	41.7	0.0	24
Alviso	A7	41.9	6.5	0.0	45.2	6.5	31
Alviso	A8	64.2	22.6	0.0	13.2	0.0	53
Alviso	A8S	40.7	3.7	0.0	55.6	0.0	54
Alviso	A8W	57.1	14.3	0.0	28.6	0.0	14
Alviso	A9	35.7	28.6	0.0	35.7	0.0	28
Alviso	AB1	46.6	17.2	8.6	6.9	20.7	58
Alviso	AB2	39.5	54.3	4.9	1.2	0.0	81
Coyote Hills	N1A	32.6	58.9	0.0	6.3	2.1	95
Coyote Hills	N2A	87.0	4.3	0.0	8.7	0.0	23
Coyote Hills	N3A	83.8	0.0	0.0	15.7	0.5	191
Coyote Hills	N4	76.9	0.0	0.0	23.1	0.0	26
Coyote Hills	N4AA	68.8	11.2	1.2	16.2	2.5	80
Coyote Hills	N4AB	84.8	2.8	2.8	9.6	0.0	178
Coyote Hills	N4B	22.5	60.0	0.0	17.5	0.0	40
Coyote Hills	N5	43.8	25.0	0.0	25.0	6.2	32
Coyote Hills	N6	93.3	6.7	0.0	0.0	0.0	15
Coyote Hills	N7	78.1	6.2	0.0	15.6	0.0	32
Coyote Hills	N8	86.2	10.3	0.0	3.4	0.0	29
Coyote Hills	N9	80.8	7.7	0.0	7.7	3.8	26
Dumbarton	N1	0.0	0.0	0.0	100.0	0.0	2
Dumbarton	N2	40.0	10.0	10.0	40.0	0.0	10
Dumbarton	N3	40.7	3.7	0.0	29.6	25.9	27
Dumbarton	NPP1	0.0	50.0	25.0	25.0	0.0	4

Complex	Pond	% Foraging	% Roosting	% Island	% Levee	% Manmade	N
Eden Landing	CP3C	81.0	16.7	0.0	0.0	2.4	42
Eden Landing	E1	23.1	11.5	3.8	46.2	15.4	26
Eden Landing	E10	26.6	47.7	4.7	17.2	3.9	128
Eden Landing	E11	25.0	43.8	0.0	31.2	0.0	16
Eden Landing	E12	79.7	13.3	0.0	4.7	2.3	128
Eden Landing	E13	73.7	15.8	0.0	10.5	0.0	19
Eden Landing	E14	56.2	25.0	0.0	18.8	0.0	16
Eden Landing	E1C	42.9	14.3	0.0	42.9	0.0	7
Eden Landing	E2	70.7	3.2	5.0	13.5	7.7	222
Eden Landing	E2C	66.7	0.0	0.0	11.1	22.2	18
Eden Landing	E4	75.8	5.5	0.0	2.2	16.5	91
Eden Landing	E4C	33.3	33.3	0.0	0.0	33.3	3
Eden Landing	E5	100.0	0.0	0.0	0.0	0.0	1
Eden Landing	E5C	88.9	0.0	0.0	0.0	11.1	9
Eden Landing	E6A	76.8	14.3	1.8	1.8	5.4	56
Eden Landing	E6B	37.5	25.0	0.0	12.5	25.0	8
Eden Landing	E6C	0.0	0.0	0.0	50.0	50.0	2
Eden Landing	E7	28.3	36.7	0.0	6.7	28.3	60
Eden Landing	E8	31.6	63.2	0.0	5.3	0.0	19
Eden Landing	E8AE	55.6	44.4	0.0	0.0	0.0	9
Eden Landing	E8AW	15.4	76.9	0.0	7.7	0.0	13
Eden Landing	E8XN	53.8	15.4	0.0	15.4	15.4	13
Eden Landing	E8XS	20.0	20.0	0.0	60.0	0.0	5
Eden Landing	E9	20.3	8.5	0.0	59.3	11.9	59
Mowry	M1	0.0	100.0	0.0	0.0	0.0	1
Mowry	M2	0.0	0.0	100.0	0.0	0.0	1
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	3
Ravenswood	R1	47.9	51.4	0.0	0.7	0.0	146
Ravenswood	R2	0.0	0.0	0.0	100.0	0.0	1
Ravenswood	R3	22.2	55.6	0.0	22.2	0.0	9
Ravenswood	R4	66.7	16.7	0.0	16.7	0.0	6
Ravenswood	R5	0.0	100.0	0.0	0.0	0.0	4
Ravenswood	R5S	33.3	66.7	0.0	0.0	0.0	3
Ravenswood	RSF2U1	61.9	3.6	21.4	10.7	2.4	84
Ravenswood	RSF2U2	25.8	12.9	51.6	3.2	6.5	31
Ravenswood	RSF2U4	66.7	16.7	0.0	16.7	0.0	6

Table A4.10. Percentage of phalaropes foraging, roosting, and using islands, levees, or manmade structures in each pond, South San Francisco Bay, California; September 2023 - May 2024. 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	1
Alviso	A5	78.0	22.0	0	0	0	900
Alviso	A7	100.0	0.0	0	0	0	377
Alviso	A9	100.0	0.0	0	0	0	678
Coyote Hills	N3A	100.0	0.0	0	0	0	1
Dumbarton	N1	100.0	0.0	0	0	0	21
Dumbarton	NPP1	100.0	0.0	0	0	0	2
Eden Landing	E12	98.3	1.7	0	0	0	410
Eden Landing	E13	99.6	0.4	0	0	0	1121
Eden Landing	E14	100.0	0.0	0	0	0	3
Eden Landing	E2	100.0	0.0	0	0	0	43
Eden Landing	E5	100.0	0.0	0	0	0	1047
Eden Landing	E5C	100.0	0.0	0	0	0	1
Eden Landing	E6	100.0	0.0	0	0	0	342
Eden Landing	E7	100.0	0.0	0	0	0	43
Eden Landing	E8	100.0	0.0	0	0	0	24
Mowry	M2	0.0	100.0	0	0	0	75
Ravenswood	R2	100.0	0.0	0	0	0	12

Table A4.11. Percentage of medium shorebirds foraging, roosting, and using islands, levees, or manmade structures in each pond, South San Francisco Bay, California; September 2023 - May 2024. 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	25.0	75.0	0.0	0.0	0.0	4
Alviso	A10	26.7	0.0	0.0	73.3	0.0	15
Alviso	A11	88.5	1.9	0.0	9.6	0.0	52
Alviso	A12	0.0	0.0	100.0	0.0	0.0	2
Alviso	A13	57.3	42.7	0.0	0.0	0.0	117
Alviso	A14	2.2	2.5	0.0	95.2	0.0	314
Alviso	A15	48.1	51.9	0.0	0.0	0.0	52
Alviso	A16	14.5	62.8	22.7	0.0	0.0	887
Alviso	A17	88.0	12.0	0.0	0.0	0.0	674
Alviso	A19	72.9	27.1	0.0	0.0	0.0	779
Alviso	A22	42.8	57.2	0.0	0.0	0.0	1264
Alviso	A23	34.3	65.7	0.0	0.0	0.0	1765
Alviso	A2E	29.4	11.8	0.0	23.5	35.3	17
Alviso	A2W	29.4	29.4	0.0	35.3	5.9	34
Alviso	A3N	73.9	26.1	0.0	0.0	0.0	1629
Alviso	A3W	58.3	25.0	0.0	16.7	0.0	12
Alviso	A5	46.2	15.4	0.0	38.5	0.0	65
Alviso	A6S	2.4	97.6	0.0	0.0	0.0	41
Alviso	A7	32.6	23.2	8.4	35.8	0.0	95
Alviso	A8	39.8	42.6	0.0	17.6	0.0	108
Alviso	A8S	60.0	18.3	0.0	21.7	0.0	115
Alviso	A8W	52.5	0.0	0.0	47.5	0.0	40
Alviso	A9	34.3	65.6	0.0	0.1	0.0	6875
Alviso	AB1	3.6	96.0	0.4	0.0	0.0	4878
Alviso	AB2	15.8	83.6	0.3	0.3	0.0	1298
Coyote Hills	N1A	4.8	0.4	0.0	94.8	0.0	915
Coyote Hills	N2A	0.6	0.2	0.2	99.0	0.0	481
Coyote Hills	N3A	14.1	58.4	0.0	27.0	0.4	929
Coyote Hills	N4	0.8	56.5	41.9	0.8	0.0	3367
Coyote Hills	N4AA	81.5	3.6	0.0	0.0	14.9	249
Coyote Hills	N4AB	14.0	0.0	0.0	86.0	0.0	50
Coyote Hills	N4B	58.1	41.1	0.0	0.2	0.5	924
Coyote Hills	N5	1.7	2.5	0.0	94.1	1.7	118
Coyote Hills	N6	100.0	0.0	0.0	0.0	0.0	12
Coyote Hills	N7	1.3	0.0	0.0	98.7	0.0	75
Coyote Hills	N8	81.8	18.2	0.0	0.0	0.0	11
Coyote Hills	N9	32.2	58.4	8.4	0.9	0.0	214
Dumbarton	N1	30.3	38.5	11.2	0.3	19.8	769
Dumbarton	N2	10.3	37.9	0.0	51.7	0.0	29
Dumbarton	N3	0.0	1.7	8.8	89.5	0.0	1504

Complex	Pond	% Foraging	% Roosting	% Island	% Levee	% Manmade	N
Dumbarton	NPP1	39.2	59.9	0.8	0.1	0.1	1800
Eden Landing	CP3C	38.7	55.7	0.0	0.0	5.6	1789
Eden Landing	E1	2.1	2.5	22.7	72.6	0.0	559
Eden Landing	E10	11.1	78.7	7.9	0.0	2.4	1472
Eden Landing	E11	16.2	76.0	0.0	0.0	7.8	1142
Eden Landing	E12	50.0	35.4	1.8	8.7	4.1	2942
Eden Landing	E13	57.4	33.2	2.9	1.3	5.2	1494
Eden Landing	E14	84.8	15.2	0.0	0.0	0.0	132
Eden Landing	E1C	96.3	3.3	0.4	0.0	0.0	786
Eden Landing	E2	12.0	0.6	87.5	0.0	0.0	886
Eden Landing	E2C	63.3	36.7	0.0	0.0	0.0	559
Eden Landing	E4	11.2	88.8	0.0	0.0	0.1	1975
Eden Landing	E4C	62.2	23.4	0.0	0.0	14.4	2146
Eden Landing	E5	33.5	64.1	0.0	0.0	2.4	1396
Eden Landing	E5C	59.5	39.8	0.0	0.1	0.6	772
Eden Landing	E6	43.7	51.4	0.0	0.0	4.9	286
Eden Landing	E6A	27.5	72.4	0.0	0.1	0.0	957
Eden Landing	E6B	3.2	96.8	0.0	0.0	0.0	1265
Eden Landing	E6C	44.2	55.5	0.0	0.3	0.0	1330
Eden Landing	E7	6.4	11.0	0.1	0.0	82.5	801
Eden Landing	E8	0.6	90.2	0.3	0.0	8.9	3103
Eden Landing	E8AE	22.3	77.7	0.0	0.0	0.0	430
Eden Landing	E8AW	0.1	99.9	0.0	0.0	0.0	1220
Eden Landing	E8XN	100.0	0.0	0.0	0.0	0.0	1
Eden Landing	E8XS	0.0	100.0	0.0	0.0	0.0	1
Eden Landing	E9	2.0	97.6	0.3	0.0	0.1	2137
Mowry	M1	22.6	50.9	0.1	26.4	0.0	2902
Mowry	M2	1.6	37.7	32.8	27.9	0.0	2816
Mowry	M3	16.9	1.5	78.7	2.9	0.0	2150
Mowry	M4	64.6	30.8	0.0	4.6	0.0	65
Mowry	M5	0.0	73.7	26.3	0.0	0.0	118
Mowry	M6	88.9	0.0	0.0	11.1	0.0	18
Ravenswood	R1	14.0	86.0	0.0	0.0	0.0	1589
Ravenswood	R2	92.6	7.4	0.0	0.0	0.0	282
Ravenswood	R3	47.3	52.1	0.6	0.0	0.0	332
Ravenswood	R4	6.4	93.6	0.0	0.0	0.0	450
Ravenswood	R5	64.0	36.0	0.0	0.0	0.0	89
Ravenswood	R5S	14.3	83.1	0.0	2.6	0.0	77
Ravenswood	RSF2U1	8.0	83.1	5.9	3.0	0.1	11798
Ravenswood	RSF2U2	4.5	36.1	47.6	11.8	0.0	6705
Ravenswood	RSF2U3	47.3	52.7	0.0	0.0	0.0	110
Ravenswood	RSF2U4	20.8	8.3	0.0	70.8	0.0	24

Table A4.12. Percentage of small shorebirds foraging, roosting, and using islands, levees, or manmade structures in each pond, South San Francisco Bay, California; September 2023 - May 2024. 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	100.0	0.0	0.0	0.0	0.0	1
Alviso	A10	53.3	0.0	0.0	46.7	0.0	30
Alviso	A11	50.0	0.0	0.0	50.0	0.0	52
Alviso	A13	67.3	32.7	0.0	0.1	0.0	3711
Alviso	A14	5.6	0.0	0.0	94.4	0.0	18
Alviso	A15	64.8	35.2	0.0	0.0	0.0	4015
Alviso	A16	3.8	95.8	0.4	0.0	0.0	452
Alviso	A17	98.4	1.6	0.0	0.0	0.0	64
Alviso	A19	58.3	41.7	0.0	0.0	0.0	12
Alviso	A22	74.7	25.3	0.0	0.0	0.0	1895
Alviso	A23	89.5	10.5	0.0	0.0	0.0	200
Alviso	A2E	97.4	2.6	0.0	0.0	0.0	38
Alviso	A2W	14.0	0.0	0.0	1.9	84.1	107
Alviso	A3N	32.1	57.5	0.0	0.6	9.8	501
Alviso	A3W	69.2	0.0	0.0	30.8	0.0	78
Alviso	A5	15.7	2.2	0.0	82.0	0.0	267
Alviso	A6S	100.0	0.0	0.0	0.0	0.0	21
Alviso	A7	3.6	5.7	0.6	90.1	0.0	334
Alviso	A8	8.4	57.1	0.0	34.4	0.0	154
Alviso	A8S	11.0	51.6	0.0	37.4	0.0	91
Alviso	A8W	33.3	0.0	0.0	66.7	0.0	3
Alviso	A9	18.0	82.0	0.0	0.0	0.0	3727
Alviso	AB1	42.3	19.6	36.1	0.0	2.0	643
Alviso	AB2	82.3	17.6	0.1	0.0	0.0	1229
Coyote Hills	N1A	36.1	0.0	0.0	63.9	0.0	288
Coyote Hills	N2A	58.6	15.5	15.5	10.3	0.0	58
Coyote Hills	N3A	59.0	36.0	0.0	5.0	0.0	3703
Coyote Hills	N4	43.4	43.0	7.8	5.8	0.0	309
Coyote Hills	N4AA	88.4	11.6	0.0	0.0	0.0	2370
Coyote Hills	N4AB	100.0	0.0	0.0	0.0	0.0	60
Coyote Hills	N4B	95.5	1.2	0.0	0.0	3.3	1260
Coyote Hills	N5	97.1	2.9	0.0	0.0	0.0	70
Coyote Hills	N6	95.9	4.1	0.0	0.0	0.0	903
Coyote Hills	N7	100.0	0.0	0.0	0.0	0.0	672
Coyote Hills	N8	90.3	0.0	0.0	9.7	0.0	720
Coyote Hills	N9	91.7	3.9	1.2	3.2	0.0	1893
Dumbarton	N1	48.6	48.2	1.6	0.4	1.2	771
Dumbarton	N2	63.3	20.0	16.7	0.0	0.0	30
Dumbarton	N3	4.9	2.3	65.6	27.3	0.0	884

Complex	Pond	% Foraging	% Roosting	% Island	% Levee	% Manmade	N
Dumbarton	NPP1	21.0	78.4	0.2	0.2	0.2	7801
Eden Landing	CP3C	84.2	15.8	0.0	0.0	0.0	7422
Eden Landing	E1	26.9	53.8	6.6	12.7	0.0	197
Eden Landing	E10	55.0	42.3	2.7	0.0	0.0	633
Eden Landing	E11	66.4	24.2	1.8	7.6	0.0	223
Eden Landing	E12	32.6	48.7	0.3	18.4	0.1	6379
Eden Landing	E13	22.2	75.0	0.4	0.6	1.8	14999
Eden Landing	E14	84.5	15.5	0.0	0.0	0.0	17851
Eden Landing	E1C	90.5	9.5	0.0	0.0	0.0	1696
Eden Landing	E2	40.7	44.5	14.5	0.3	0.0	7494
Eden Landing	E2C	86.4	13.6	0.0	0.0	0.0	4185
Eden Landing	E4	72.3	27.7	0.0	0.0	0.0	1413
Eden Landing	E4C	33.7	61.9	0.0	0.0	4.3	12070
Eden Landing	E5	51.3	6.5	0.0	0.0	42.2	154
Eden Landing	E5C	46.1	53.9	0.0	0.0	0.0	4898
Eden Landing	E6	24.2	75.8	0.0	0.0	0.1	1750
Eden Landing	E6A	30.9	69.1	0.0	0.0	0.0	6670
Eden Landing	E6B	77.2	22.8	0.0	0.0	0.0	11259
Eden Landing	E6C	93.7	5.0	0.0	0.0	1.3	987
Eden Landing	E7	73.1	24.0	2.9	0.0	0.0	242
Eden Landing	E8	20.1	74.0	0.0	0.0	6.0	1880
Eden Landing	E8AE	80.2	19.8	0.0	0.0	0.0	913
Eden Landing	E8AW	100.0	0.0	0.0	0.0	0.0	7
Eden Landing	E8XS	100.0	0.0	0.0	0.0	0.0	50
Eden Landing	E9	90.9	9.1	0.0	0.0	0.0	3986
Mowry	M1	3.9	6.6	0.1	89.4	0.0	13147
Mowry	M2	3.5	6.5	17.8	72.1	0.0	12898
Mowry	M3	29.4	9.0	54.8	6.8	0.0	10963
Mowry	M4	49.5	35.2	0.0	15.3	0.0	596
Mowry	M5	28.1	71.9	0.0	0.0	0.0	6732
Mowry	M6	50.9	49.0	0.0	0.1	0.0	6157
Ravenswood	R1	56.2	43.8	0.0	0.0	0.0	51161
Ravenswood	R2	35.5	64.5	0.0	0.0	0.0	19684
Ravenswood	R3	82.4	17.6	0.0	0.0	0.0	165
Ravenswood	R4	31.9	68.1	0.0	0.0	0.0	6166
Ravenswood	R5	34.4	65.6	0.0	0.0	0.0	430
Ravenswood	R5S	100.0	0.0	0.0	0.0	0.0	140
Ravenswood	RSF2U1	59.8	23.3	14.6	2.4	0.0	2706
Ravenswood	RSF2U2	3.0	63.0	0.9	33.1	0.0	1628
Ravenswood	RSF2U3	41.6	58.4	0.0	0.0	0.0	1616
Ravenswood	RSF2U4	28.1	71.9	0.0	0.0	0.0	32

Table A4.13. Percentage of terns foraging, roosting, and using islands, levees, or manmade structures in each pond, South San Francisco Bay, California; September 2023 - May 2024. 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	67.4	0.0	0.0	0.0	32.6	89
Alviso	A10	24.3	21.4	0.0	54.3	0.0	70
Alviso	A11	3.7	0.0	31.3	64.9	0.0	268
Alviso	A12	0.0	100.0	0.0	0.0	0.0	2
Alviso	A14	10.7	0.4	0.0	88.9	0.0	810
Alviso	A15	0.0	100.0	0.0	0.0	0.0	3
Alviso	A16	0.2	34.2	64.1	0.0	1.5	587
Alviso	A17	100.0	0.0	0.0	0.0	0.0	5
Alviso	A22	0.0	16.7	0.0	0.0	83.3	6
Alviso	A2E	8.8	0.0	0.0	0.0	91.2	34
Alviso	A2W	69.2	0.0	0.0	0.0	30.8	65
Alviso	A3N	100.0	0.0	0.0	0.0	0.0	30
Alviso	A3W	58.3	0.0	0.0	0.0	41.7	103
Alviso	A5	96.6	0.0	3.4	0.0	0.0	29
Alviso	A7	100.0	0.0	0.0	0.0	0.0	14
Alviso	A8	12.5	0.0	0.0	83.9	3.6	56
Alviso	A8S	12.1	0.0	0.0	86.4	1.5	66
Alviso	A8W	0.0	7.1	0.0	87.7	5.2	154
Alviso	A9	37.9	19.7	0.0	0.0	42.4	66
Alviso	AB1	41.3	0.0	55.6	0.0	3.2	63
Alviso	AB2	7.7	0.0	23.1	0.0	69.2	13
Coyote Hills	N1A	14.7	1.5	0.0	79.4	4.4	136
Coyote Hills	N2A	90.3	0.0	0.0	9.7	0.0	31
Coyote Hills	N3A	17.2	14.1	0.0	17.2	51.6	64
Coyote Hills	N4	55.0	0.0	0.0	0.0	45.0	20
Coyote Hills	N4AA	1.0	1.8	0.0	0.0	97.3	512
Coyote Hills	N4AB	87.7	0.0	0.0	1.5	10.8	65
Coyote Hills	N4B	100.0	0.0	0.0	0.0	0.0	1
Coyote Hills	N5	41.7	0.0	0.0	0.0	58.3	36
Coyote Hills	N6	66.7	0.0	0.0	0.0	33.3	9
Coyote Hills	N7	3.3	0.0	0.0	94.8	2.0	153
Coyote Hills	N8	100.0	0.0	0.0	0.0	0.0	1
Coyote Hills	N9	100.0	0.0	0.0	0.0	0.0	5
Dumbarton	N1	0.0	72.7	0.0	0.0	27.3	11
Dumbarton	N2	0.0	0.0	0.0	0.0	100.0	1
Dumbarton	N3	85.0	0.0	0.0	0.0	15.0	20
Eden Landing	CP3C	0.0	0.0	0.0	0.0	100.0	110
Eden Landing	E1	44.7	42.7	3.9	0.0	8.7	103
Eden Landing	E10	33.3	1.5	0.0	0.0	65.2	66

Complex	Pond	% Foraging	% Roosting	% Island	% Levee	% Manmade	N
Eden Landing	E11	33.3	0.0	0.0	0.0	66.7	6
Eden Landing	E12	12.6	0.9	3.7	19.5	63.3	215
Eden Landing	E13	0.0	0.0	0.0	0.0	100.0	2
Eden Landing	E14	100.0	0.0	0.0	0.0	0.0	1
Eden Landing	E2	59.2	9.6	5.6	0.0	25.6	125
Eden Landing	E2C	100.0	0.0	0.0	0.0	0.0	2
Eden Landing	E4	33.3	0.0	0.0	0.0	66.7	6
Eden Landing	E5	0.0	0.0	0.0	0.0	100.0	28
Eden Landing	E5C	0.0	0.0	0.0	0.0	100.0	7
Eden Landing	E6A	11.1	72.2	0.0	0.0	16.7	36
Eden Landing	E6B	25.0	0.0	0.0	0.0	75.0	4
Eden Landing	E6C	85.7	0.0	0.0	0.0	14.3	7
Eden Landing	E7	2.7	4.5	0.0	0.2	92.6	619
Eden Landing	E8	100.0	0.0	0.0	0.0	0.0	2
Eden Landing	E8AW	50.0	50.0	0.0	0.0	0.0	2
Eden Landing	E8XN	100.0	0.0	0.0	0.0	0.0	5
Mowry	M2	0.0	33.3	0.0	0.0	66.7	6
Ravenswood	R1	70.4	29.6	0.0	0.0	0.0	54
Ravenswood	R2	14.3	0.0	0.0	0.0	85.7	7
Ravenswood	R3	84.6	15.4	0.0	0.0	0.0	13
Ravenswood	R4	67.7	32.3	0.0	0.0	0.0	62
Ravenswood	RSF2U1	6.7	13.4	44.8	0.0	35.1	299
Ravenswood	RSF2U2	1.4	1.0	86.7	0.7	10.1	286
Ravenswood	RSF2U4	100.0	0.0	0.0	0.0	0.0	2

Appendix 5

This appendix presents AICc tables (one per species/guild) summarizing the model selection results for the regression models relating inter-annual changes in seasonal waterbird abundance to changes in habitats and weather. The final two tables contain the "base" AICc tables for fitting site characteristics for Bonaparte's Gulls and phalaropes (see Van Schmidt and Parsons 2023 for details).

Table A5.1. Model selection table for interannual change in abundance of Ruddy Ducks during winter in current and former salt ponds in South San Francisco Bay, California, water year 2003-2024. Model selection was carried out based on corrected Akaike Information Criterion (AICc); only the top 20 models are shown. Site characteristics were not subject to model selection (see text for details), but were instead obtained from De La Cruz et al. (2018).

Formula	K	dAICc	AICc	-2LL	w
Abun_PC ~ BayDist_km + Islands_num + Area_km2 + LDO_mgL + LDO_mgL_AC + pH + pH_AC + Salinity + Salinity_AC + WaterElev_m_AC	13	0.00	4806.42	-2390.04	0.04
Abun_PC ~ BayDist_km + Islands_num + Area_km2 + LDO_mgL + LDO_mgL_AC + pH + pH_AC + Salinity + Salinity_AC + TMN + WaterElev_m_AC	14	0.44	4806.85	-2389.23	0.03
Abun_PC ~ BayDist_km + Islands_num + Area_km2 + LDO_mgL + LDO_mgL_AC + pH + pH_AC + Salinity + Salinity_AC	12	0.54	4806.95	-2391.33	0.03
Abun_PC ~ BayDist_km + Islands_num + Area_km2 + LDO_mgL + LDO_mgL_AC + pH + pH_AC + PPT0 + Salinity + Salinity_AC + WaterElev_m_AC	14	0.65	4807.06	-2389.33	0.03
Abun_PC ~ BayDist_km + Islands_num + Area_km2 + LDO_mgL + LDO_mgL_AC + pH + pH_AC + PPT0 + Salinity + Salinity_AC	13	0.81	4807.22	-2390.44	0.03
Abun_PC ~ BayDist_km + Islands_num + Area_km2 + LDO_mgL + LDO_mgL_AC + pH + pH_AC + Salinity + Salinity_AC + TMN	13	0.92	4807.34	-2390.50	0.02

Formula	K	dAICc	AICc	-2LL	w
Abun_PC ~ BayDist_km + Islands_num + Area_km2 + LDO_mgL + LDO_mgL_AC + pH + pH_AC + PPT3 + Salinity + Salinity_AC + WaterElev_m_AC	14	1.28	4807.70	-2389.65	0.02
Abun_PC ~ BayDist_km + Islands_num + Area_km2 + LDO_mgL + LDO_mgL_AC + pH + pH_AC + PPT1 + Salinity + Salinity_AC + WaterElev_m_AC	14	1.54	4807.95	-2389.78	0.02
Abun_PC ~ BayDist_km + Islands_num + Area_km2 + LDO_mgL + LDO_mgL_AC + pH + pH_AC + PPT0 + Salinity + Salinity_AC + TMN + WaterElev_m_AC	15	1.54	4807.96	-2388.75	0.02
Abun_PC ~ BayDist_km + Islands_num + Area_km2 + Gated + LDO_mgL + LDO_mgL_AC + pH + pH_AC + Salinity + Salinity_AC + WaterElev_m_AC	14	1.63	4808.05	-2389.83	0.02
Abun_PC ~ BayDist_km + Islands_num + Area_km2 + LDO_mgL + LDO_mgL_AC + pH + pH_AC + PPT3 + Salinity + Salinity_AC	13	1.70	4808.12	-2390.89	0.02
Abun_PC ~ BayDist_km + Islands_num + Area_km2 + LDO_mgL + LDO_mgL_AC + pH + pH_AC + PPT0 + Salinity + Salinity_AC + TMN	14	1.71	4808.13	-2389.87	0.02
Abun_PC ~ BayDist_km + Islands_num + Area_km2 + Breached + LDO_mgL + LDO_mgL_AC + pH + pH_AC + Salinity + Salinity_AC + WaterElev_m_AC	14	2.00	4808.42	-2390.01	0.01
Abun_PC ~ BayDist_km + Islands_num + Area_km2 + LDO_mgL + LDO_mgL_AC + pH + pH_AC + Salinity + Salinity_AC + TMX + WaterElev_m_AC	14	2.04	4808.46	-2390.03	0.01
Abun_PC ~ BayDist_km + Islands_num + Area_km2 + LDO_mgL + LDO_mgL_AC + pH + pH_AC + PPT0 + Salinity + Salinity_AC + TMX + WaterElev_m_AC	15	2.10	4808.52	-2389.03	0.01
Abun_PC ~ BayDist_km + Islands_num + Area_km2 + Gated + LDO_mgL + LDO_mgL_AC + pH + pH_AC + Salinity + Salinity_AC + TMN + WaterElev_m_AC	15	2.18	4808.59	-2389.07	0.01
Abun_PC ~ BayDist_km + Islands_num + Area_km2 + LDO_mgL + LDO_mgL_AC + pH + pH_AC + PPT0 + Salinity + Salinity_AC + TMX	14	2.22	4808.63	-2390.12	0.01
Abun_PC ~ BayDist_km + Islands_num + Area_km2 + LDO_mgL + LDO_mgL_AC + pH + pH_AC + Salinity + Salinity_AC + TMN + TMX + WaterElev_m_AC	15	2.24	4808.65	-2389.10	0.01
Abun_PC ~ BayDist_km + Islands_num + Area_km2 + LDO_mgL + LDO_mgL_AC + pH + pH_AC + PPT1 + Salinity + Salinity_AC	13	2.24	4808.66	-2391.16	0.01
Abun_PC ~ BayDist_km + Islands_num + Area_km2 + Gated + LDO_mgL + LDO_mgL_AC + pH + pH_AC + Salinity + Salinity_AC	13	2.25	4808.66	-2391.16	0.01

Table A5.2. Model selection table for interannual change in abundance of diving ducks during winter in current and former salt ponds in South San Francisco Bay, California, water year 2003-2024. Model selection was carried out based on corrected Akaike Information Criterion (AICc); only the top 20 models are shown. Site characteristics were not subject to model selection (see text for details), but were instead obtained from De La Cruz et al. (2018).

Formula	K	dAICc	AICc	-2LL	w
Abun_PC ~ BayDist_km + Islands_num + Area_km2 + PPT1 + Salinity + Salinity_AC + TMN + TMX	11	0.00	5193.23	-2585.51	0.02
Abun_PC ~ BayDist_km + Islands_num + Area_km2 + PPT0 + Salinity + Salinity_AC	9	0.06	5193.29	-2587.58	0.02
Abun_PC ~ BayDist_km + Islands_num + Area_km2 + PPT1 + Salinity + Salinity_AC + TMN + TMX + WaterElev_m_AC	12	0.19	5193.43	-2584.59	0.02
Abun_PC ~ BayDist_km + Islands_num + Area_km2 + PPT0 + Salinity + Salinity_AC + WaterElev_m_AC	10	0.28	5193.51	-2586.67	0.02
Abun_PC ~ BayDist_km + Islands_num + Area_km2 + pH + pH_AC + PPT0 + Salinity + Salinity_AC	11	0.30	5193.54	-2585.67	0.02
Abun_PC ~ BayDist_km + Islands_num + Area_km2 + pH + pH_AC + PPT0 + Salinity + Salinity_AC + WaterElev_m_AC	12	0.68	5193.91	-2584.84	0.01
Abun_PC ~ BayDist_km + Islands_num + Area_km2 + pH + pH_AC + PPT1 + Salinity + Salinity_AC + TMN + TMX	13	0.76	5194.00	-2583.86	0.01
Abun_PC ~ BayDist_km + Islands_num + Area_km2 + pH + pH_AC + PPT1 + Salinity + Salinity_AC + TMN + TMX + WaterElev_m_AC	14	1.09	5194.32	-2583.00	0.01
Abun_PC ~ BayDist_km + Islands_num + Area_km2 + Salinity + Salinity_AC + TMN + TMX + WaterElev_m_AC	11	1.25	5194.48	-2586.14	0.01
Abun_PC ~ BayDist_km + Islands_num + Area_km2 + Breached + PPT1 + Salinity + Salinity_AC + TMN + TMX	12	1.55	5194.79	-2585.27	0.01
Abun_PC ~ BayDist_km + Islands_num + Area_km2 + Salinity + Salinity_AC + WaterElev_m_AC	9	1.56	5194.80	-2588.33	0.01
Abun_PC ~ BayDist_km + Islands_num + Area_km2 + Salinity + Salinity_AC + TMN + TMX	10	1.59	5194.83	-2587.33	0.01
Abun_PC ~ BayDist_km + Islands_num + Area_km2 + Breached + PPT0 + Salinity + Salinity_AC	10	1.62	5194.86	-2587.34	0.01

Formula	K	dAICc	AICc	-2LL	w
Abun_PC ~ BayDist_km + Islands_num + Area_km2 + Breached + PPT1 + Salinity + Salinity_AC + TMN + TMX + WaterElev_m_AC	13	1.64	5194.87	-2584.29	0.01
Abun_PC ~ BayDist_km + Islands_num + Area_km2 + Breached + PPT0 + Salinity + Salinity_AC + WaterElev_m_AC	11	1.73	5194.96	-2586.38	0.01
Abun_PC ~ BayDist_km + Islands_num + Area_km2 + pH + pH_AC + PPT0 + Salinity + Salinity_AC + TMN	12	1.80	5195.04	-2585.40	0.01
Abun_PC ~ BayDist_km + Islands_num + Area_km2 + PPT0 + Salinity + Salinity_AC + TMN	10	1.85	5195.08	-2587.46	0.01
Abun_PC ~ BayDist_km + Islands_num + Area_km2 + Gated + PPT0 + Salinity + Salinity_AC	10	1.95	5195.18	-2587.51	0.01
Abun_PC ~ BayDist_km + Islands_num + Area_km2 + Gated + PPT1 + Salinity + Salinity_AC + TMN + TMX	12	1.97	5195.20	-2585.48	0.01
Abun_PC ~ BayDist_km + Islands_num + Area_km2 + Salinity + Salinity_AC	8	1.97	5195.21	-2589.55	0.01

Table A5.3. Model selection table for interannual change in abundance of small shorebirds during fall and spring in current and former salt ponds in South San Francisco Bay, California, water year 2003-2024. Model selection was carried out based on corrected Akaike Information Criterion (AICc); only the top 20 models are shown. Site characteristics were not subject to model selection (see text for details), but were instead obtained from De La Cruz et al. (2018).

Formula	**K**	**dAICc**	**AICc**	**-2LL**	**w**
Abun_PC ~ CreekDist_km + Islands_num + OpenPublic_pct + Breached + PPT3 + Salinity + Salinity_AC + WaterElev_m_AC + Spring	12	0.00	10413.07	-5194.46	0.08
Abun_PC ~ CreekDist_km + Islands_num + OpenPublic_pct + Breached + PPT3 + Salinity + Salinity_AC + Temp_C + Temp_C_AC + WaterElev_m_AC + Spring	14	1.27	10414.34	-5193.07	0.04
Abun_PC ~ CreekDist_km + Islands_num + OpenPublic_pct + Breached + PPT3 + Salinity + Salinity_AC + TMN + WaterElev_m_AC + Spring	13	1.30	10414.37	-5194.10	0.04
Abun_PC ~ CreekDist_km + Islands_num + OpenPublic_pct + PPT3 + Salinity + Salinity_AC + WaterElev_m_AC + Spring	11	1.37	10414.44	-5196.16	0.04
Abun_PC ~ CreekDist_km + Islands_num + OpenPublic_pct + Breached + PPT3 + Salinity + Salinity_AC + TMX + WaterElev_m_AC + Spring	13	1.82	10414.88	-5194.36	0.03
Abun_PC ~ CreekDist_km + Islands_num + OpenPublic_pct + Breached + Gated + PPT3 + Salinity + Salinity_AC + WaterElev_m_AC + Spring	13	1.96	10415.03	-5194.43	0.03
Abun_PC ~ CreekDist_km + Islands_num + OpenPublic_pct + PPT3 + Salinity + Salinity_AC + Temp_C + Temp_C_AC + WaterElev_m_AC + Spring	13	2.55	10415.62	-5194.72	0.02
Abun_PC ~ CreekDist_km + Islands_num + OpenPublic_pct + PPT3 + Salinity + Salinity_AC + TMN + WaterElev_m_AC + Spring	12	2.66	10415.73	-5195.79	0.02
Abun_PC ~ CreekDist_km + Islands_num + OpenPublic_pct + Breached + PPT3 + Salinity + Salinity_AC + Temp_C + Temp_C_AC + TMN + WaterElev_m_AC + Spring	15	2.77	10415.83	-5192.80	0.02
Abun_PC ~ CreekDist_km + Islands_num + OpenPublic_pct + Breached + pH + pH_AC + PPT3 + Salinity + Salinity_AC + WaterElev_m_AC + Spring	14	2.96	10416.03	-5193.92	0.02
Abun_PC ~ CreekDist_km + Islands_num + OpenPublic_pct + PPT3 + Salinity + Salinity_AC + TMX + WaterElev_m_AC + Spring	12	3.00	10416.07	-5195.96	0.02
Abun_PC ~ CreekDist_km + Islands_num + OpenPublic_pct + Breached + LDO_mgL + LDO_mgL_AC + PPT3 + Salinity + Salinity_AC + WaterElev_m_AC + Spring	14	3.17	10416.24	-5194.02	0.02

Formula	K	dAICc	AICc	-2LL	w
Abun_PC ~ CreekDist_km + Islands_num + OpenPublic_pct + Breached + Gated + PPT3 + Salinity + Salinity_AC + Temp_C + Temp_C_AC + WaterElev_m_AC + Spring	15	3.24	10416.31	-5193.04	0.02
Abun_PC ~ CreekDist_km + Islands_num + OpenPublic_pct + Breached + PPT3 + Salinity + Salinity_AC + Temp_C + Temp_C_AC + TMX + WaterElev_m_AC + Spring	15	3.26	10416.32	-5193.05	0.02
Abun_PC ~ CreekDist_km + Islands_num + OpenPublic_pct + Breached + Gated + PPT3 + Salinity + Salinity_AC + TMN + WaterElev_m_AC + Spring	14	3.28	10416.34	-5194.07	0.02
Abun_PC ~ CreekDist_km + Islands_num + OpenPublic_pct + Gated + PPT3 + Salinity + Salinity_AC + WaterElev_m_AC + Spring	12	3.38	10416.45	-5196.15	0.01
Abun_PC ~ CreekDist_km + Islands_num + OpenPublic_pct + Breached + Salinity + Salinity_AC + WaterElev_m_AC + Spring	11	3.71	10416.77	-5197.33	0.01
Abun_PC ~ CreekDist_km + Islands_num + OpenPublic_pct + Breached + Gated + PPT3 + Salinity + Salinity_AC + TMX + WaterElev_m_AC + Spring	14	3.78	10416.84	-5194.32	0.01
Abun_PC ~ CreekDist_km + Islands_num + OpenPublic_pct + PPT3 + Salinity + Salinity_AC + Temp_C + Temp_C_AC + TMN + WaterElev_m_AC + Spring	14	4.04	10417.11	-5194.46	0.01
Abun_PC ~ CreekDist_km + Islands_num + OpenPublic_pct + Breached + pH + pH_AC + PPT3 + Salinity + Salinity_AC + Temp_C + Temp_C_AC + WaterElev_m_AC + Spring	16	4.12	10417.18	-5192.46	0.01

Table A5.4. Model selection table for interannual change in abundance of Eared Grebes during winter in current and former salt ponds in South San Francisco Bay, California, water year 2003-2024. Model selection was carried out based on corrected Akaike Information Criterion (AICc); only the top 20 models are shown. Site characteristics were not subject to model selection (see text for details), but were instead obtained from De La Cruz et al. (2018).

Formula	**K**	**dAICc**	**AICc**	**-2LL**	**w**
Abun_PC ~ Islands_num + Area_km2 + WaterElev_m_AC	6	0.00	4005.68	-1996.80	0.02
Abun_PC ~ Islands_num + Area_km2 + PPT1 + WaterElev_m_AC	7	0.12	4005.80	-1995.84	0.02
Abun_PC ~ Islands_num + Area_km2 + PPT1 + TMN + WaterElev_m_AC	8	0.61	4006.29	-1995.07	0.01
Abun_PC ~ Islands_num + Area_km2 + Breached + WaterElev_m_AC	7	0.68	4006.36	-1996.13	0.01
Abun_PC ~ Islands_num + Area_km2 + Breached + PPT1 + WaterElev_m_AC	8	0.70	4006.38	-1995.12	0.01
Abun_PC ~ Islands_num + Area_km2 + TMX + WaterElev_m_AC	7	0.74	4006.42	-1996.15	0.01
Abun_PC ~ Islands_num + Area_km2 + PPT1 + TMX + WaterElev_m_AC	8	1.09	4006.77	-1995.31	0.01
Abun_PC ~ Islands_num + Area_km2 + Gated + WaterElev_m_AC	7	1.11	4006.79	-1996.34	0.01
Abun_PC ~ Islands_num + Area_km2 + TMN + WaterElev_m_AC	7	1.14	4006.83	-1996.36	0.01
Abun_PC ~ Islands_num + Area_km2 + Breached + PPT1 + TMN + WaterElev_m_AC	9	1.15	4006.84	-1994.33	0.01
Abun_PC ~ Islands_num + Area_km2 + Breached + TMX + WaterElev_m_AC	8	1.21	4006.89	-1995.37	0.01
Abun_PC ~ Islands_num + Area_km2 + Gated + PPT1 + WaterElev_m_AC	8	1.23	4006.91	-1995.38	0.01
Abun_PC ~ Islands_num + Area_km2 + Breached + PPT1 + TMX + WaterElev_m_AC	9	1.48	4007.16	-1994.49	0.01
Abun_PC ~ Islands_num + Area_km2 + PPT3 + WaterElev_m_AC	7	1.76	4007.44	-1996.66	0.01
Abun_PC ~ Islands_num + Area_km2 + Breached + TMN + WaterElev_m_AC	8	1.81	4007.49	-1995.67	0.01
Abun_PC ~ Islands_num + Area_km2 + Breached + Gated + WaterElev_m_AC	8	1.86	4007.54	-1995.70	0.01
Abun_PC ~ Islands_num + Area_km2 + Breached + Gated + PPT1 + WaterElev_m_AC	9	1.88	4007.57	-1994.69	0.01
Abun_PC ~ Islands_num + Area_km2 + Gated + PPT1 + TMN + WaterElev_m_AC	9	1.88	4007.57	-1994.69	0.01
Abun_PC ~ Islands_num + Area_km2 + Gated + TMX + WaterElev_m_AC	8	1.90	4007.58	-1995.72	0.01
Abun_PC ~ Islands_num + Area_km2 + PPT0 + WaterElev_m_AC	7	1.98	4007.67	-1996.78	0.01

Table A5.5. Model selection table for interannual change in abundance of phalaropes during summer in current and former salt ponds in South San Francisco Bay, California, water year 2003-2024. Model selection was carried out based on corrected Akaike Information Criterion (AICc); only the top 20 models are shown. Site characteristics were not subject to model selection (see text for details), but were instead obtained from De La Cruz et al. (2018).

Formula	**K**	**dAICc**	**AICc**	**-2LL**	**w**
Abun_PC ~ PPT1 + Salinity + Salinity_AC + WaterElev_m_AC	7	0.00	1233.32	-609.41	0.02
Abun_PC ~ LDO_mgL + LDO_mgL_AC + PPT1 + Salinity + Salinity_AC + WaterElev_m_AC	9	0.13	1233.46	-607.33	0.02
Abun_PC ~ PPT1 + Salinity + Salinity_AC + TMX + WaterElev_m_AC	8	0.46	1233.78	-608.57	0.01
Abun_PC ~ PPT1 + Salinity + Salinity_AC	6	0.75	1234.07	-610.85	0.01
Abun_PC ~ PPT1 + Temp_C + Temp_C_AC + WaterElev_m_AC	7	0.78	1234.10	-609.80	0.01
Abun_PC ~ Salinity + Salinity_AC + WaterElev_m_AC	6	0.79	1234.11	-610.87	0.01
Abun_PC ~ PPT1 + WaterElev_m_AC	5	0.81	1234.13	-611.93	0.01
Abun_PC ~ LDO_mgL + LDO_mgL_AC + PPT1 + Salinity + Salinity_AC	8	0.84	1234.17	-608.76	0.01
Abun_PC ~ LDO_mgL + LDO_mgL_AC + Salinity + Salinity_AC + WaterElev_m_AC	8	0.94	1234.26	-608.81	0.01
Abun_PC ~ PPT1 + Salinity + Salinity_AC + TMX	7	0.94	1234.26	-609.88	0.01
Abun_PC ~ PPT1 + TMX + WaterElev_m_AC	6	1.01	1234.33	-610.98	0.01
Abun_PC ~ PPT1 + Salinity + Salinity_AC + Temp_C + Temp_C_AC + WaterElev_m_AC	9	1.10	1234.42	-607.81	0.01
Abun_PC ~ LDO_mgL + LDO_mgL_AC + PPT1 + Salinity + Salinity_AC + TMX + WaterElev_m_AC	10	1.17	1234.49	-606.75	0.01
Abun_PC ~ Salinity + Salinity_AC	5	1.33	1234.65	-612.19	0.01
Abun_PC ~ PPT0 + Salinity + Salinity_AC + WaterElev_m_AC	7	1.34	1234.66	-610.08	0.01
Abun_PC ~ PPT1 + TMX	5	1.35	1234.67	-612.21	0.01
Abun_PC ~ PPT1	4	1.39	1234.71	-613.27	0.01
Abun_PC ~ LDO_mgL + LDO_mgL_AC + Salinity + Salinity_AC	7	1.49	1234.81	-610.16	0.01
Abun_PC ~ LDO_mgL + LDO_mgL_AC + PPT0 + Salinity + Salinity_AC + WaterElev_m_AC	9	1.63	1234.95	-608.07	0.01
Abun_PC ~ LDO_mgL + LDO_mgL_AC + PPT1 + Salinity + Salinity_AC + TMX	9	1.64	1234.96	-608.08	0.01

Table A5.6. Model selection table for interannual change in abundance of Bonaparte's Gulls during winter in current and former salt ponds in South San Francisco Bay, California, water year 2003-2024. Model selection was carried out based on corrected Akaike Information Criterion (AICc); only the top 20 models are shown. Site characteristics were not subject to model selection (see text for details), but were instead obtained from De La Cruz et al. (2018).

Formula	**K**	**dAICc**	**AICc**	**-2LL**	**w**
Abun_PC ~ Temp_C + Temp_C_AC	5	0.00	1890.79	-940.31	0.04
Abun_PC ~ Temp_C + Temp_C_AC + TMN	6	0.27	1891.06	-939.42	0.03
Abun_PC ~ Temp_C + Temp_C_AC + TMX	6	0.49	1891.28	-939.53	0.03
Abun_PC ~ Salinity + Salinity_AC + Temp_C + Temp_C_AC	7	1.36	1892.14	-938.92	0.02
Abun_PC ~ Temp_C + Temp_C_AC + TMN + TMX	7	1.81	1892.60	-939.15	0.02
Abun_PC ~ PPT3 + Temp_C + Temp_C_AC + TMN	7	1.89	1892.67	-939.19	0.01
Abun_PC ~ Salinity + Salinity_AC + Temp_C + Temp_C_AC + TMN	8	1.97	1892.75	-938.18	0.01
Abun_PC ~ Temp_C + Temp_C_AC + WaterElev_m_AC	6	2.00	1892.79	-940.28	0.01
Abun_PC ~ PPT3 + Temp_C + Temp_C_AC	6	2.06	1892.84	-940.31	0.01
Abun_PC ~ BreachOrGate + Temp_C + Temp_C_AC	6	2.06	1892.85	-940.31	0.01
Abun_PC ~ PPT0 + Temp_C + Temp_C_AC	6	2.06	1892.85	-940.31	0.01
Abun_PC ~ PPT1 + Temp_C + Temp_C_AC	6	2.06	1892.85	-940.31	0.01
Abun_PC ~ PPT0 + Temp_C + Temp_C_AC + TMX	7	2.14	1892.93	-939.31	0.01
Abun_PC ~ Salinity + Salinity_AC + Temp_C + Temp_C_AC + TMX	8	2.22	1893.01	-938.31	0.01
Abun_PC ~ PPT1 + Temp_C + Temp_C_AC + TMN	7	2.24	1893.02	-939.36	0.01
Abun_PC ~ PPT0 + Temp_C + Temp_C_AC + TMN	7	2.28	1893.07	-939.38	0.01
Abun_PC ~ Temp_C + Temp_C_AC + TMN + WaterElev_m_AC	7	2.32	1893.11	-939.40	0.01
Abun_PC ~ BreachOrGate + Temp_C + Temp_C_AC + TMN	7	2.35	1893.13	-939.42	0.01
Abun_PC ~ PPT3 + Temp_C + Temp_C_AC + TMX	7	2.53	1893.31	-939.51	0.01
Abun_PC ~ Temp_C + Temp_C_AC + TMX + WaterElev_m_AC	7	2.55	1893.34	-939.52	0.01

Table A5.7. Model selection table for interannual change in abundance of dabbling ducks during winter in current and former salt ponds in South San Francisco Bay, California, water year 2003-2024. Model selection was carried out based on corrected Akaike Information Criterion (AICc); only the top 20 models are shown. Site characteristics were not subject to model selection (see text for details), but were instead obtained from De La Cruz et al. (2018).

Formula	K	dAICc	AICc	-2LL	w
Abun_PC ~ Islands_num + OpenHunting_pct + PPT1 + Salinity + Salinity_AC	8	0.00	5418.83	-2701.35	0.03
Abun_PC ~ Islands_num + OpenHunting_pct + Salinity + Salinity_AC	7	0.65	5419.48	-2702.70	0.02
Abun_PC ~ Islands_num + OpenHunting_pct + LDO_mgL + LDO_mgL_AC + PPT1 + Salinity + Salinity_AC	10	1.01	5419.83	-2699.83	0.02
Abun_PC ~ Islands_num + OpenHunting_pct + PPT1 + Salinity + Salinity_AC + WaterElev_m_AC	9	1.17	5419.99	-2700.92	0.02
Abun_PC ~ Islands_num + OpenHunting_pct + Salinity + Salinity_AC + WaterElev_m_AC	8	1.59	5420.41	-2702.15	0.01
Abun_PC ~ Islands_num + OpenHunting_pct + PPT1 + Salinity + Salinity_AC + TMX	9	1.72	5420.55	-2701.20	0.01
Abun_PC ~ Islands_num + OpenHunting_pct + LDO_mgL + LDO_mgL_AC + Salinity + Salinity_AC	9	1.89	5420.72	-2701.29	0.01
Abun_PC ~ Islands_num + OpenHunting_pct + Gated + PPT1 + Salinity + Salinity_AC	9	1.95	5420.77	-2701.31	0.01
Abun_PC ~ Islands_num + OpenHunting_pct + Breached + PPT1 + Salinity + Salinity_AC	9	2.01	5420.84	-2701.35	0.01
Abun_PC ~ Islands_num + OpenHunting_pct + PPT1 + Salinity + Salinity_AC + TMN	9	2.03	5420.85	-2701.35	0.01
Abun_PC ~ Islands_num + OpenHunting_pct + LDO_mgL + LDO_mgL_AC + PPT1 + Salinity + Salinity_AC + WaterElev_m_AC	11	2.19	5421.01	-2699.40	0.01
Abun_PC ~ Islands_num + OpenHunting_pct + Salinity + Salinity_AC + TMX	8	2.57	5421.39	-2702.64	0.01
Abun_PC ~ Islands_num + OpenHunting_pct + PPT3 + Salinity + Salinity_AC	8	2.61	5421.43	-2702.66	0.01
Abun_PC ~ Islands_num + OpenHunting_pct + Gated + Salinity + Salinity_AC	8	2.61	5421.44	-2702.66	0.01
Abun_PC ~ Islands_num + OpenHunting_pct + Salinity + Salinity_AC + TMN	8	2.61	5421.44	-2702.66	0.01
Abun_PC ~ Islands_num + OpenHunting_pct + PPT0 + Salinity + Salinity_AC	8	2.64	5421.47	-2702.68	0.01
Abun_PC ~ Islands_num + OpenHunting_pct + Breached + Salinity + Salinity_AC	8	2.68	5421.50	-2702.69	0.01

Formula	K	dAICc	AICc	-2LL	w
Abun_PC ~ Islands_num + OpenHunting_pct + LDO_mgL + LDO_mgL_AC + PPT1 + Salinity + Salinity_AC + TMX	11	2.70	5421.53	-2699.66	0.01
Abun_PC ~ Islands_num + OpenHunting_pct + LDO_mgL + LDO_mgL_AC + Salinity + Salinity_AC + WaterElev_m_AC	10	2.82	5421.65	-2700.74	0.01
Abun_PC ~ Islands_num + OpenHunting_pct + PPT1 + Salinity + Salinity_AC + Temp_C + Temp_C_AC	10	2.89	5421.71	-2700.77	0.01

Table A5.8. Model selection table for interannual change in abundance of medium shorebirds during winter in current and former salt ponds in South San Francisco Bay, California, water year 2003-2024. Model selection was carried out based on corrected Akaike Information Criterion (AICc); only the top 20 models are shown. Site characteristics were not subject to model selection (see text for details), but were instead obtained from De La Cruz et al. (2018).

Formula	K	dAICc	AICc	-2LL	w
Abun_PC ~ CreekDist_km + Islands_num + Salinity + Salinity_AC + TMX + WaterElev_m_AC	9	0.00	5943.22	-2962.54	0.04
Abun_PC ~ CreekDist_km + Islands_num + Salinity + Salinity_AC + WaterElev_m_AC	8	0.29	5943.51	-2963.70	0.04
Abun_PC ~ CreekDist_km + Islands_num + PPT1 + Salinity + Salinity_AC + TMX + WaterElev_m_AC	10	1.09	5944.32	-2962.07	0.03
Abun_PC ~ CreekDist_km + Islands_num + PPT0 + Salinity + Salinity_AC + WaterElev_m_AC	9	1.24	5944.46	-2963.16	0.02
Abun_PC ~ CreekDist_km + Islands_num + Salinity + Salinity_AC + TMN + WaterElev_m_AC	9	1.26	5944.48	-2963.17	0.02
Abun_PC ~ CreekDist_km + Islands_num + PPT1 + Salinity + Salinity_AC + WaterElev_m_AC	9	1.58	5944.81	-2963.33	0.02
Abun_PC ~ CreekDist_km + Islands_num + PPT0 + Salinity + Salinity_AC + TMN + WaterElev_m_AC	10	1.61	5944.84	-2962.33	0.02
Abun_PC ~ CreekDist_km + Islands_num + PPT0 + Salinity + Salinity_AC + TMX + WaterElev_m_AC	10	1.87	5945.09	-2962.46	0.02
Abun_PC ~ CreekDist_km + Islands_num + Salinity + Salinity_AC + TMN + TMX + WaterElev_m_AC	10	1.87	5945.09	-2962.46	0.02
Abun_PC ~ CreekDist_km + Islands_num + PPT3 + Salinity + Salinity_AC + TMX + WaterElev_m_AC	10	1.94	5945.16	-2962.50	0.02
Abun_PC ~ CreekDist_km + Islands_num + Breached + Salinity + Salinity_AC + TMX + WaterElev_m_AC	10	2.02	5945.25	-2962.54	0.02
Abun_PC ~ CreekDist_km + Islands_num + Gated + Salinity + Salinity_AC + TMX + WaterElev_m_AC	10	2.02	5945.25	-2962.54	0.02
Abun_PC ~ CreekDist_km + Islands_num + PPT3 + Salinity + Salinity_AC + WaterElev_m_AC	9	2.11	5945.34	-2963.60	0.02
Abun_PC ~ CreekDist_km + Islands_num + LDO_mgL + LDO_mgL_AC + Salinity + Salinity_AC + TMX + WaterElev_m_AC	11	2.21	5945.43	-2961.61	0.01
Abun_PC ~ CreekDist_km + Islands_num + Breached + Salinity + Salinity_AC + WaterElev_m_AC	9	2.26	5945.49	-2963.67	0.01

Formula	K	dAICc	AICc	-2LL	w
Abun_PC ~ CreekDist_km + Islands_num + Gated + Salinity + Salinity_AC + WaterElev_m_AC	9	2.31	5945.54	-2963.70	0.01
Abun_PC ~ CreekDist_km + Islands_num + LDO_mgL + LDO_mgL_AC + Salinity + Salinity_AC + WaterElev_m_AC	10	2.58	5945.80	-2962.81	0.01
Abun_PC ~ CreekDist_km + Islands_num + PPT1 + Salinity + Salinity_AC + TMN + WaterElev_m_AC	10	2.79	5946.01	-2962.92	0.01
Abun_PC ~ CreekDist_km + Islands_num + PPT1 + Salinity + Salinity_AC + TMN + TMX + WaterElev_m_AC	11	3.09	5946.31	-2962.05	0.01
Abun_PC ~ CreekDist_km + Islands_num + Breached + PPT1 + Salinity + Salinity_AC + TMX + WaterElev_m_AC	11	3.11	5946.34	-2962.06	0.01

Table A5.9. Model selection table for base model of pond characteristics related to change in abundance of Bonaparte's Gulls during winter in current and former salt ponds in South San Francisco Bay, California, water year 2003-2024. Model selection was carried out based on corrected Akaike Information Criterion (AICc); only the top 20 models are shown.

Formula	**K**	**dAICc**	**AICc**	**-2LL**	**w**
Abun_PC ~ 1	3	0.00	1894.48	-944.21	0.11
Abun_PC ~ Area_km2	4	1.75	1896.23	-944.06	0.04
Abun_PC ~ CreekDist_km	4	1.94	1896.42	-944.16	0.04
Abun_PC ~ BayDist_km	4	1.96	1896.44	-944.17	0.04
Abun_PC ~ LandfillDist_km	4	1.99	1896.47	-944.18	0.04
Abun_PC ~ OpenPublic_pct	4	2.00	1896.48	-944.19	0.04
Abun_PC ~ Islands_num	4	2.01	1896.49	-944.19	0.04
Abun_PC ~ OpenHunting_pct	4	2.02	1896.50	-944.20	0.04
Abun_PC ~ Area_km2 + CreekDist_km	5	3.61	1898.09	-943.97	0.02
Abun_PC ~ Area_km2 + BayDist_km	5	3.76	1898.24	-944.04	0.02
Abun_PC ~ Area_km2 + OpenHunting_pct	5	3.78	1898.26	-944.05	0.02
Abun_PC ~ Area_km2 + OpenPublic_pct	5	3.79	1898.27	-944.06	0.02
Abun_PC ~ Area_km2 + Islands_num	5	3.80	1898.28	-944.06	0.02
Abun_PC ~ Area_km2 + LandfillDist_km	5	3.80	1898.29	-944.06	0.02
Abun_PC ~ CreekDist_km + LandfillDist_km	5	3.88	1898.37	-944.10	0.02
Abun_PC ~ BayDist_km + CreekDist_km	5	3.91	1898.39	-944.12	0.02
Abun_PC ~ BayDist_km + LandfillDist_km	5	3.91	1898.39	-944.12	0.02
Abun_PC ~ LandfillDist_km + OpenHunting_pct	5	3.94	1898.42	-944.13	0.01
Abun_PC ~ CreekDist_km + Islands_num	5	3.94	1898.42	-944.13	0.01
Abun_PC ~ LandfillDist_km + OpenPublic_pct	5	3.95	1898.43	-944.14	0.01

Table A5.10. Model selection table for base model of pond characteristics related to change in abundance of phalaropes during summer in current and former salt ponds in South San Francisco Bay, California, water year 2003-2024. Model selection was carried out based on corrected Akaike Information Criterion (AICc); only the top 20 models are shown.

Formula	**K**	**dAICc**	**AICc**	**-2LL**	**w**
Abun_PC ~ 1	3	0.00	1235.46	-614.68	0.09
Abun_PC ~ CreekDist_km	4	0.78	1236.24	-614.03	0.06
Abun_PC ~ OpenPublic_pct	4	1.68	1237.14	-614.48	0.04
Abun_PC ~ BayDist_km	4	1.98	1237.44	-614.63	0.03
Abun_PC ~ LandfillDist_km	4	1.99	1237.46	-614.64	0.03
Abun_PC ~ OpenHunting_pct	4	2.03	1237.49	-614.66	0.03
Abun_PC ~ Area_km2	4	2.07	1237.53	-614.68	0.03
Abun_PC ~ Islands_num	4	2.07	1237.53	-614.68	0.03
Abun_PC ~ CreekDist_km + OpenPublic_pct	5	2.59	1238.05	-613.89	0.02
Abun_PC ~ Area_km2 + CreekDist_km	5	2.64	1238.10	-613.92	0.02
Abun_PC ~ CreekDist_km + Islands_num	5	2.83	1238.30	-614.02	0.02
Abun_PC ~ CreekDist_km + OpenHunting_pct	5	2.84	1238.30	-614.02	0.02
Abun_PC ~ CreekDist_km + LandfillDist_km	5	2.86	1238.32	-614.03	0.02
Abun_PC ~ BayDist_km + CreekDist_km	5	2.86	1238.33	-614.03	0.02
Abun_PC ~ BayDist_km + OpenPublic_pct	5	3.43	1238.89	-614.31	0.02
Abun_PC ~ OpenHunting_pct + OpenPublic_pct	5	3.76	1239.22	-614.48	0.01
Abun_PC ~ Area_km2 + OpenPublic_pct	5	3.76	1239.22	-614.48	0.01
Abun_PC ~ LandfillDist_km + OpenPublic_pct	5	3.76	1239.23	-614.48	0.01
Abun_PC ~ Islands_num + OpenPublic_pct	5	3.77	1239.23	-614.48	0.01
Abun_PC ~ BayDist_km + LandfillDist_km	5	3.87	1239.33	-614.53	0.01

Appendix 6

This appendix presents a table of the mean water quality measures per season (Table A6.1).

Table A6.1. Annual and seasonal water quality and depth measures (mean across surveys), and change in those measures compared to the same time period last year, in current and former salt ponds in South San Francisco Bay, California, September 2023 – May 2024.

Location	**Pond**	**Season**	**Salinity (ppt)**	**DO (mg/L)**	**pH**	**Temp (C)**	**Staff gauge (ft)**	**Salinity (ppt)**	**DO (mg/L)**	**pH**	**Temp (C)**	**Staff gauge (ft)**
Alviso	A1	Year	30.19	7.66	8.45	17.44	1.86	9.89	-2.39	0.21	1.55	0.08
	A1	Fall	26.85	6.57	8.14	20.28	1.80	-4.91	-2.93	-0.09	1.10	0.25
	A1	Winter	46.07	7.81	8.56	12.48	2.15	29.43	-2.49	0.54	0.59	0.10
	A1	Spring	17.65	8.59	8.66	19.56	1.60	5.15	-1.75	0.17	2.94	-0.15
	A10	Year	21.59	9.05	8.32	21.16	1.50	-2.75	-0.72	0.04	7.77	
	A10	Fall	26.10	6.65	8.05	21.53		-10.43	-3.36	-0.25	3.85	
	A10	Winter	21.80	10.55	8.35	15.41	1.50	-0.69	-0.95	-0.19	7.32	
	A10	Spring	16.88	9.95	8.57	26.56		2.87	2.17	0.57	12.17	
	A11	Year	21.06	8.89	8.20	21.08		-3.70	-2.93	-0.03	4.56	
	A11	Fall	24.77	8.46	7.89	22.18		-10.75	-5.61	-0.45	2.14	
	A11	Winter	22.30	9.84	8.19	15.75		-2.33	-1.39	0.13	4.34	
	A11	Spring	16.11	8.36	8.53	25.30		1.99	-1.82	0.23	7.17	
	A12	Year	287.75	6.96	7.35	23.27		27.47	-3.10	-0.21	4.90	
	A12	Fall	322.83	7.37	6.66	25.21		33.16	-3.27	-0.64	3.55	
	A12	Winter	283.00	8.37	7.63	17.22		44.83	-2.41	0.02	5.10	
	A12	Spring	257.43	5.14	7.77	27.38		4.43	-3.61	-0.01	6.05	
	A13	Year	182.13	10.86	7.80	22.78		88.69	2.77	-0.59	5.73	
	A13	Fall	242.50	6.98	7.32	26.20		156.58	-0.51	-0.31	3.74	
	A13	Winter	170.05	11.80	8.11	17.26		87.58	2.44	-0.49	3.80	
	A13	Spring	133.83	13.78	7.98	24.87		21.91	6.34	-0.95	9.63	
	A14	Year	21.12	10.63	8.25	20.26	1.12	3.56	-0.42	0.08	5.60	-0.45
	A14	Fall	26.37	11.00	8.08	22.41	0.95	-4.16	-0.55	0.01	4.27	-0.25
	A14	Winter	22.67	9.06	8.19	15.34	1.30	9.19	-2.06	0.12	2.81	-0.30
	A14	Spring	14.31	11.82	8.47	23.03	1.10	5.65	1.34	0.11	9.71	-0.65
	A15	Year	234.39	6.99	7.45	22.87	-0.80	72.10	-2.60	-0.45	6.44	0.08
	A15	Fall	298.00	10.37	7.23	26.87		66.00	-2.21	-0.09	5.98	
	A15	Winter	218.54	7.84	7.68	16.20	-0.80	100.42	-1.91	-0.64	2.75	-0.10
	A15	Spring	186.62	2.75	7.43	25.52		49.87	-3.69	-0.63	10.57	
	A16	Year	12.61	12.77	8.64	20.09	3.50	-2.09	1.68	0.07	2.83	-0.10
	A16	Fall	18.16	9.59	8.02	22.80	3.00	-8.47	3.58	-0.37	0.96	-0.50
	A16	Winter	13.53	12.87	8.58	15.00	3.75	0.05	0.15	0.23	3.17	0.05
	A16	Spring	6.14	15.86	9.31	22.48	3.75	2.14	1.33	0.34	4.37	0.15
	A17	Year	9.07	7.21	7.86	20.02	6.94	-1.33	-1.14	-0.03	2.40	-0.29
	A17	Fall	12.94	6.57	7.99	22.11	7.90	-8.58	-0.21	0.15	0.31	1.30
	A17	Winter	9.14	7.72	7.51	14.72	7.70	1.27	-1.08	-0.21	2.92	-0.40

Location	Pond	Season	Salinity (ppt)	DO (mg/L)	pH	Temp (C)	Staff gauge (ft)	Salinity (ppt)	DO (mg/L)	pH	Temp (C)	Staff gauge (ft)
Alviso	A17	Spring	5.15	7.35	8.06	23.22	5.70	3.34	-2.11	-0.05	3.96	-1.30
	A19	Year	8.63	7.16	7.86	19.31		6.33	-3.70	-0.08	5.97	
	A19	Fall	12.04	5.36	7.73	19.92		8.44	-1.03	0.19	5.83	
	A19	Winter	6.88	8.09	7.61	11.76		4.34	-4.06	-0.39	-1.49	
	A19	Spring	3.57	9.85	8.36	25.64		3.05	-2.87	0.14	12.88	
	A22	Year	137.26	9.79	8.20	18.31		63.89	1.95	-0.04	3.22	
	A22	Fall	303.50	9.49	6.92	18.70		166.54	3.97	-0.61	0.77	
	A22	Winter	42.27	8.51	8.45	12.25		-3.19	-2.88	-0.11	0.02	
	A22	Spring	66.00	11.35	9.22	23.98		28.32	4.73	0.58	8.88	
	A23	Year	205.50	5.44	7.22	17.50		54.27	-3.87	-0.57	1.58	
	A23	Fall										
	A23	Winter	222.50	6.92	6.89	12.31		63.00	-3.73	-1.47	-0.62	
	A23	Spring	188.50	2.48	7.56	22.68		33.00	-3.06	0.31	7.94	
	A2E	Year	23.10	8.50	8.53	17.68		-3.73	-1.61	-0.03	2.56	
	A2E	Fall	31.67	5.76	8.40	17.82		-11.52	-2.67	-0.17	-3.80	
	A2E	Winter	20.89	8.57	8.55	15.40		-1.37	-2.94	-0.06	4.52	
	A2E	Spring	16.73	11.15	8.64	19.84		1.68	0.77	0.14	6.98	
	A2W	Year	21.23	8.44	8.58	17.78	1.72	0.84	-1.10	0.20	1.96	0.09
	A2W	Fall	26.63	7.55	8.34	17.97	1.80	-5.13	-1.28	0.03	-0.95	0.30
	A2W	Winter	20.61	8.97	8.59	13.70	1.90	3.57	-0.24	0.45	2.18	0.10
	A2W	Spring	16.46	8.80	8.80	21.68	1.45	4.09	-1.77	0.12	4.67	-0.15
	A3N	Year	34.27	9.83	8.70	21.14	1.74	-12.05	-0.48	-0.14	3.51	-0.09
	A3N	Fall	39.52	5.48	8.66	24.06	1.95	-27.11	-4.89	-0.42	3.08	0.15
	A3N	Winter	37.02	17.10	8.93	17.11	1.90	-2.33	5.60	0.16	5.26	0.05
	A3N	Spring	27.64	10.56	8.62	20.22	1.45	-5.35	1.51	-0.04	0.16	
	A3W	Year	18.93	10.95	8.84	20.58	-0.82	-8.20	2.23	0.37	3.51	0.70
	A3W	Fall	23.75	8.60	8.69	24.02	-0.85	-12.07	0.99	0.37	4.60	0.55
	A3W	Winter	21.46	13.01	8.68	15.13	-0.70	-0.61	4.01	0.22	4.31	0.10
	A3W	Spring	12.84	12.28	9.07	19.86	-0.85	-10.66	2.73	0.44	-1.11	1.50
	A5	Year	11.02	12.71	8.66	18.86	2.17	-0.20	0.30	0.08	0.91	-0.01
	A5	Fall	17.62	10.42	8.29	21.97	2.60	-6.24	1.31	0.15	3.31	0.90
	A5	Winter	9.90	13.84	8.86	13.97	2.10	4.34	-2.42	0.03	-0.77	-0.55
	A5	Spring	5.54	13.88	8.84	20.65	2.00	1.31	2.01	0.07	0.19	0.05
	A6S	Year	11.67	9.43	8.18	17.73		-1.82	-1.30	-0.07	-0.08	
	A6S	Fall	17.97	7.37	7.96	18.07		-6.99	-1.20	0.00	1.27	
	A6S	Winter	13.02	9.21	8.07	13.48		0.51	-1.50	-0.07	-0.54	
	A6S	Spring	7.17	10.68	8.41	21.80		4.18	-2.23	-0.22	-0.81	
	A7	Year	12.07	10.46	8.44	18.47	2.18	-2.02	-1.66	-0.04	-0.21	0.16
	A7	Fall	17.95	10.03	8.10	20.28	2.40	-10.07	2.46	0.04	-2.28	0.45
	A7	Winter	9.59	10.99	8.70	14.74	2.10	-0.67	-6.79	-0.01	1.41	
	A7	Spring	8.69	10.36	8.51	20.38	2.15	4.69	-0.63	-0.15	0.22	0.05
	A8	Year	8.34	8.71	8.09	15.67		-1.94	-1.31	-0.41	-1.10	

Location	Pond	Season	Salinity (ppt)	DO (mg/L)	pH	Temp (C)	Staff gauge (ft)	Salinity (ppt)	DO (mg/L)	pH	Temp (C)	Staff gauge (ft)
Alviso	A8	Fall	16.36	10.15	8.21	19.91		-6.55	2.77	-0.11	-0.13	
	A8	Winter	6.62	7.76	7.98	12.75		0.30	-3.03	-0.34	0.42	
	A8	Spring	2.04	8.22	8.09	14.34		0.44	-3.67	-0.76	-3.61	
	A8S	Year	9.38	12.68	8.58	16.08		-1.28	-1.97	-0.08	0.02	
	A8S	Fall	14.82	10.05	8.28	19.73		-6.93	-2.49	-0.05	1.08	
	A8S	Winter	9.33	14.48	8.61	14.03		1.75	-4.22	-0.30	2.46	
	A8S	Spring	4.00	13.50	8.84	14.47		1.34	0.80	0.09	-3.49	
	A8W	Year										
	A8W	Fall										
	A8W	Winter										
	A8W	Spring										
	A9	Year	25.10	10.64	8.52	22.93	1.20	0.64	0.80	0.01	10.77	0.02
	A9	Fall	36.58	9.18	8.13	25.15	1.50	-3.95	0.22	-0.41	8.67	0.30
	A9	Winter	21.85	10.72	8.43	15.91	0.85	2.33	-2.12	-0.44	8.63	
	A9	Spring	16.88	12.03	8.98	27.72	1.25	3.54	4.30	0.85	15.01	0.10
	AB1	Year	17.88	9.65	8.35	17.71	5.78	-1.38	-0.81	0.00	2.36	0.25
	AB1	Fall	24.44	8.06	7.93	17.72	6.25	-7.42	0.48	-0.26	-3.26	0.20
	AB1	Winter	16.76	11.57	8.51	15.98	5.45	-0.83	-1.87	0.07	4.48	-0.25
	AB1	Spring	12.45	9.32	8.60	19.44	5.65	4.11	-1.04	0.17	5.86	0.80
	AB2	Year	18.24	14.20	8.81	21.02	5.82	-2.95	1.54	0.20	2.59	0.14
	AB2	Fall	23.53	13.12	8.71	24.56	6.10	-6.87	3.80	0.58	4.30	0.05
	AB2	Winter	17.91	14.25	8.73	18.67	6.80	-0.05	-0.83	0.06	6.23	1.20
	AB2	Spring	13.29	15.24	8.99	19.83	5.05	-1.93	1.67	-0.03	-2.76	-0.35
Coyote Hills	N1A	Year	29.94	9.45	8.23	16.98	2.18	-0.64	-0.09	0.22	1.11	-0.84
	N1A	Fall	31.60	10.04	8.27	21.37	2.05	-3.95	1.76	0.38	3.08	-1.80
	N1A	Winter	29.12	9.79	8.07	11.87	2.25	3.83	-1.55	0.07	-0.22	0.25
	N1A	Spring	29.09	8.52	8.33	17.71	2.25	-1.81	-0.49	0.21	0.49	-0.45
	N2A	Year	30.30	10.52	8.40	17.27	2.18	-0.71	1.96	0.55	1.39	-0.37
	N2A	Fall	31.84	11.21	8.46	19.40	2.10	-4.86	3.31	0.71	1.65	-0.35
	N2A	Winter	30.22	10.33	8.16	14.89	2.20	4.81	1.03	0.43	2.57	-0.30
	N2A	Spring	28.85	10.02	8.59	17.51	2.20	-2.07	1.55	0.50	-0.05	-0.50
	N3A	Year	32.06	7.92	8.34	16.67	2.28	0.08	-0.76	0.05	1.80	-0.42
	N3A	Fall	35.90	6.49	8.37	18.48	2.00	-4.39	-2.05	-0.16	0.93	-0.65
	N3A	Winter	31.12	9.91	8.36	14.82	2.35	5.82	1.59	-0.12	3.41	-0.20
	N3A	Spring	29.16	7.35	8.30	16.72	2.35	-1.20	-1.83	0.45	1.08	-0.55
	N4	Year	50.63	7.30	7.98	20.02	2.02	3.67	-0.98	-0.60	3.87	-0.38
	N4	Fall	50.62	7.81	7.21	26.23	2.00	-8.84	2.35	-1.56	9.74	0.15
	N4	Winter	50.76	7.80	8.33	13.08	2.00	10.66	-1.72	-0.11	0.88	-0.55
	N4	Spring	50.50	6.29	8.41	20.75	2.05	9.16	-3.57	-0.11	1.00	-0.75
	N4AA	Year	48.98	6.59	8.30	16.26	1.46	16.75	-3.47	-0.10	-0.56	-0.27
	N4AA	Fall	85.06	3.99	7.94	20.41	1.45	43.49	-4.46	-0.63	1.15	-0.05
	N4AA	Winter	32.19	10.79	8.51	12.38	1.20	6.45	0.36	0.08	-0.35	-0.50

Location	Pond	Season	Salinity (ppt)	DO (mg/L)	pH	Temp (C)	Staff gauge (ft)	Salinity (ppt)	DO (mg/L)	pH	Temp (C)	Staff gauge (ft)
Coyote Hills	N4AA	Spring	29.70	4.99	8.46	15.98	1.60	0.34	-6.30	0.27	-2.48	-0.40
	N4AB	Year	33.00	8.15	8.42	16.30		0.77	0.40	0.66	0.29	
	N4AB	Fall	36.52	8.37	8.60	17.54		-2.84	2.73	0.73	-0.66	
	N4AB	Winter	33.51	9.98	8.24	15.35		7.45	0.92	0.84	3.91	
	N4AB	Spring	28.96	6.11	8.41	15.99		-2.31	-2.42	0.41	-2.39	
	N4B	Year	35.68	9.05	8.61	16.77		2.17	-1.54	0.13	0.36	
	N4B	Fall	41.98	7.29	8.50	21.97		-7.82	0.64	0.21	1.60	
	N4B	Winter	31.87	8.13	8.54	12.79		7.26	-4.62	-0.07	2.16	
	N4B	Spring	33.18	11.74	8.78	15.56		7.05	-0.62	0.24	-2.68	
	N5	Year	48.31	8.38	7.92	16.97	1.80	1.47	-0.90	-0.66	0.20	-2.95
	N5	Fall	50.86	7.81	7.25	21.04	1.75	-10.09	-0.13	-1.62	0.30	0.05
	N5	Winter	49.86	8.88	8.32	14.12	1.50	10.37	-1.04	-0.08	2.71	-3.45
	N5	Spring	44.21	8.44	8.19	15.75	2.00	4.13	-1.55	-0.29	-2.42	-5.60
	N6	Year	40.79	7.00	7.80	20.30	2.48	1.34	2.15	-0.21	9.59	0.30
	N6	Fall	39.27	6.65	7.36	25.34	1.90	-13.90	4.98	-0.80	10.72	0.15
	N6	Winter	32.81	9.12	7.99	11.25	3.35	-2.92	4.30	-0.03	4.08	0.95
	N6	Spring	46.30	6.28	8.13	19.77	1.90	16.85	-1.76	0.27	9.42	-0.50
	N7	Year	44.48	8.00	7.95	17.45	1.34	4.33	-1.70	-0.48	1.20	-0.46
	N7	Fall	45.97	7.67	7.46	21.24	1.25	-7.97	-0.40	-1.30	0.38	-0.05
	N7	Winter	50.56	8.23	8.56	13.82	1.10	15.19	-3.02	0.26	2.93	-0.85
	N7	Spring	39.95	8.21	8.14	15.48	1.55	8.82	-1.56	-0.08	-1.52	-0.60
	N8	Year	34.61	8.36	7.97	17.10	1.66	-4.16	0.03	-0.26	1.04	-0.54
	N8	Fall	43.28	11.30	9.05	21.91	1.45	-9.49	5.62	0.70	1.44	-0.30
	N8	Winter	23.02	7.57	6.70	13.55	1.50	-11.27	-1.69	-1.28	3.64	-0.85
	N8	Spring	37.53	6.22	8.16	15.83	1.95	8.29	-3.82	-0.19	-1.96	-0.55
	N9	Year	38.05	5.64	7.82	16.86	1.30	1.43	-0.11	-0.31	5.69	-0.65
	N9	Fall	39.76	3.77	7.12	22.79	1.40	-8.06	1.38	-1.01	7.99	-0.15
	N9	Winter	37.26	3.78	7.98	11.62	0.85	3.31	-3.39	-0.25	3.73	-1.25
	N9	Spring	37.12	9.38	8.37	16.16	1.65	9.03	1.68	0.35	5.35	-0.55
	N1	Year	101.58	7.17	8.02	18.49	1.58	23.62	0.12	0.10	2.50	-0.35
	N1	Fall	107.88	9.33	7.76	23.48	1.35	1.59	1.60	-0.09	6.91	0.15
	N1	Winter	99.45	5.97	8.00	13.49	1.75	36.07	-1.73	0.00	0.62	-0.80
	N1	Spring	97.42	6.21	8.29	18.50	1.65	33.22	0.50	0.39	-0.03	-0.40
	N2	Year	76.55	7.63	8.19	18.53	2.92	5.80	0.03	0.18	4.11	-0.31
	N2	Fall	83.48	7.44	8.08	19.18	2.85	-15.92	1.49	0.33	1.40	0.05
	N2	Winter	69.47	7.15	8.07	13.95		10.83	-1.57	-0.23	1.81	
	N2	Spring	76.70	8.29	8.43	22.46	3.00	22.50	0.15	0.44	9.13	-0.50
	N3	Year	69.00	8.33	8.29	19.18	3.51	6.50	-0.03	0.04	4.01	-0.01
	N3	Fall	74.35	8.91	8.22	20.48	3.47	-11.26	2.08	-0.08	-0.57	0.17
	N3	Winter	63.39	7.54	8.23	15.68	3.40	11.65	-1.64	-0.13	4.37	-0.20
Dumbarton	N3	Spring	69.26	8.55	8.41	21.38	3.60	19.09	-0.52	0.33	8.22	-0.30
	NPP1	Year	118.12	8.32	7.83	19.31		17.80	2.29	0.08	3.20	

Location	Pond	Season	Salinity (ppt)	DO (mg/L)	pH	Temp (C)	Staff gauge (ft)	Salinity (ppt)	DO (mg/L)	pH	Temp (C)	Staff gauge (ft)
	NPP1	Fall	127.12	14.35	7.65	24.28		-0.38	9.38	0.12	7.77	
	NPP1	Winter	113.49	5.71	7.85	13.24		45.04	-1.95	-0.17	0.17	
	NPP1	Spring	113.75	4.90	7.98	20.41		8.73	-0.57	0.28	1.66	
Eden	CP3C	Year	27.91	9.12	8.60	19.04	3.76	-0.78	-0.94	-0.08	5.65	-0.12
Landing	CP3C	Fall	41.11	7.86	8.48	22.12	3.75	-10.83	1.08	-0.22	7.54	-0.20
	CP3C	Winter	26.46	8.50	8.55	12.93	4.20	3.31	-4.75	-0.13	2.83	0.40
	CP3C	Spring	16.16	11.02	8.77	22.09	3.55	5.19	0.87	0.11	6.61	-0.35
	E1	Year	25.58	9.35	7.63	20.42	3.80	-0.02	-1.26	-0.37	4.37	-0.02
	E1	Fall	33.68	9.52	6.61	24.57	3.65	-6.16	-0.25	-1.42	7.83	0.05
	E1	Winter	22.28	10.17	7.91	14.60	4.40	2.87	1.26	0.18	-0.29	0.65
	E1	Spring	20.77	8.36	8.37	22.08	3.35	3.21	-4.78	0.13	5.56	-0.75
	E10	Year	29.49	8.71	8.38	18.58	6.03	0.47	-1.18	-0.19	4.56	0.07
	E10	Fall	38.18	6.33	8.17	21.14	6.10	-4.18	-4.50	-0.53	1.98	0.05
	E10	Winter	24.64	9.18	8.08	13.05	6.60	-2.46	1.12	-0.43	5.79	0.90
	E10	Spring	25.64	10.62	8.90	21.54	5.40	8.05	-0.15	0.40	5.91	-0.60
	E11	Year	25.13	10.58	8.22	17.86	0.82	-1.02	0.90	-0.05	2.84	-0.12
	E11	Fall	31.46	8.86	8.20	21.91	0.70	-7.64	1.82	-0.08	1.85	-0.20
	E11	Winter	22.93	6.79	7.59	12.37	1.05	0.63	-4.22	-0.57	1.33	0.05
	E11	Spring	20.98	14.21	8.88	19.30	0.60	3.93	3.23	0.51	5.34	-0.30
	E12	Year	28.48	7.98	8.04	17.73	7.12	-12.47	-2.31	-0.06	1.53	0.42
	E12	Fall	37.34	7.48	7.99	21.31	6.70	-43.23	-2.10	-0.01	-0.88	0.05
	E12	Winter	25.11	8.94	7.78	14.01	7.80	1.26	-2.36	-0.35	1.02	0.50
	E12	Spring	23.00	7.52	8.34	17.87	6.85	4.56	-2.48	0.18	4.45	0.40
	E13	Year	27.31	7.84	8.19	18.58	6.10	2.44	-2.56	-0.07	3.55	0.37
	E13	Fall	36.70	4.07	7.96	22.14	6.25	-0.87	-6.37	-0.47	0.93	0.40
	E13	Winter	24.29	8.36	8.05	15.13	6.00	2.16	-0.69	-0.06	4.78	0.10
	E13	Spring	20.93	11.08	8.55	18.48	6.05	6.01	-0.64	0.30	4.94	0.60
	E14	Year	23.02	9.48	8.12	16.47	5.07	-1.48	0.91	0.08	0.14	-0.38
	E14	Fall	32.15	9.71	7.97	19.99	5.10	-5.68	3.37	-0.37	-1.29	0.20
	E14	Winter	21.60	8.13	7.87	11.95	5.25	1.29	-1.97	0.11	1.63	-0.90
	E14	Spring	15.31	10.60	8.53	17.46	4.85	-0.04	1.32	0.53	0.08	-0.45
	E1C	Year	67.83	7.36	8.27	18.26	4.15	-8.58	-1.13	-0.08	3.90	0.08
	E1C	Fall	113.11	6.00	7.82	21.63	3.80	-37.39	0.16	0.14	5.67	-0.15
	E1C	Winter	43.11	7.09	8.34	13.95	4.45	-6.03	-3.80	-0.02	2.81	0.40
	E1C	Spring	47.26	8.99	8.66	19.20	3.90	17.67	0.23	-0.33	3.23	-0.30
	E2	Year	35.60	10.39	8.62	22.38	3.67	1.45	0.03	0.12	3.82	0.15
	E2	Fall	49.55	11.70	8.82	28.52	3.50	-6.11	6.34	0.02	9.39	0.15
	E2	Winter	27.50	9.29	8.33	13.48	4.05	0.62	-7.13	-0.10	-2.20	0.55
	E2	Spring	29.76	10.17	8.72	25.13	3.45	9.84	0.88	0.43	4.25	-0.25
	E2C	Year	30.98	8.59	8.40	17.38	3.42	5.74	-0.57	0.08	3.67	-0.16
	E2C	Fall	33.73	8.10	8.18	20.14	3.70	-10.33	0.44	-0.33	5.52	0.05
	E2C	Winter	22.78	8.52	8.25	12.63	4.35	3.62	-1.85	0.11	1.64	0.70

Location	Pond	Season	Salinity (ppt)	DO (mg/L)	pH	Temp (C)	Staff gauge (ft)	Salinity (ppt)	DO (mg/L)	pH	Temp (C)	Staff gauge (ft)
Eden	E2C	Spring	36.44	9.15	8.77	19.37	1.00	23.96	-0.30	0.46	3.84	-2.45
Landing	E4	Year	48.23	9.54	8.73	19.78	4.52	0.88	-1.20	0.27	-0.44	0.82
	E4	Fall	50.71	9.46	8.67	26.32	2.90	-26.29	2.45	0.35	3.07	-0.65
	E4	Winter	53.78	10.28	8.52	13.65	4.30	11.54	-2.39	0.01	-2.14	0.30
	E4	Spring	40.22	8.87	8.99	19.38	6.60	17.42	-3.68	0.43	-2.26	2.90
	E4C	Year	82.54	6.13	8.37	20.13		9.71	-1.58	0.10	7.25	
	E4C	Fall	116.00	4.30	7.97	22.69		-14.50	0.63	0.27	8.99	
	E4C	Winter	52.41	6.30	8.51	13.50		-4.51	-4.45	-0.05	3.41	
	E4C	Spring	75.90	9.45	8.90	28.26		44.81	0.72	0.36	13.40	
	E5	Year	73.45	7.42	8.49	18.06	4.10	-11.08	-1.88	0.20	1.60	-0.07
	E5	Fall	87.10	4.26	8.03	19.53	4.25	-58.57	-3.77	0.18	-0.48	0.20
	E5	Winter	75.19	10.20	8.50	14.95	4.20	-1.22	-3.25	-0.09	1.37	-0.10
	E5	Spring	58.06	7.81	8.95	19.71	3.90	26.56	1.38	0.53	3.94	-0.25
	E5C	Year	46.35	8.56	8.63	18.61	4.27	-10.08	0.27	0.41	5.05	0.15
	E5C	Fall	49.88	7.25	8.38	20.98	3.90	-54.02	3.14	0.53	6.63	-0.10
	E5C	Winter	48.18	7.96	8.70	14.27	4.45	2.93	-3.90	0.25	3.60	0.35
	E5C	Spring	40.99	10.46	8.84	20.59		20.86	1.57	0.48	4.94	
	E6	Year	61.93	7.68	8.91	18.36		6.20	-3.50	0.25	0.49	
	E6	Fall	91.05	8.28	8.95	23.50		1.11	-1.54	0.39	3.68	
	E6	Winter	53.89	7.14	8.82	13.58		6.26	-5.20	-0.12	0.01	
	E6	Spring	40.86	7.62	8.95	17.99		11.24	-3.76	0.48	-2.23	
	E6A	Year	23.98	13.55	8.43	19.02	2.48	-0.02	3.84	0.01	5.03	-0.57
	E6A	Fall	36.71	15.16	8.36	19.23	2.35	-3.20	6.71	0.01	1.89	-1.60
	E6A	Winter	21.38	12.02	8.34	15.51	3.40	2.88	-1.12	-0.13	4.47	0.00
	E6A	Spring	13.87	13.47	8.61	22.33	1.70	0.30	5.92	0.17	8.74	-0.10
	E6B	Year	24.52	10.09	8.31	19.62	2.12	-2.09	1.30	0.12	5.43	-0.81
	E6B	Fall	34.77	9.98	8.32	23.09	2.75	-8.71	2.02	0.10	5.69	-0.95
	E6B	Winter	22.99	8.11	8.21	15.04	2.25	0.99	-2.57	0.07	4.28	-1.05
	E6B	Spring	15.78	12.17	8.40	20.71	1.35	1.44	4.44	0.20	6.31	-0.45
	E6C	Year	129.21	6.22	8.13	17.83	4.00	-8.66	-3.54	0.02	0.26	-0.12
	E6C	Fall	162.00	4.56	7.72	17.81	3.80	-85.50	-4.52	0.33	-6.06	0.00
	E6C	Winter	135.25	9.02	8.13	16.54	4.55	4.96	-4.41	-0.12	3.54	0.10
	E6C	Spring	106.78	5.09	8.53	19.16	3.55	70.97	-1.69	-0.17	3.30	-0.55
	E7	Year	36.28	8.74	8.52	21.32		4.36	-3.04	0.17	3.67	
	E7	Fall	43.12	8.04	8.34	25.40		-6.98	1.26	-0.23	5.66	
	E7	Winter	30.38	7.46	8.24	13.20		6.65	-13.20	0.08	-1.68	
	E7	Spring	35.33	10.74	8.97	25.36		13.40	2.84	0.64	7.03	
	E8	Year	25.77	11.32	8.00	19.84	3.06	0.88	0.87	-0.26	5.00	-0.42
	E8	Fall	35.00	9.04	8.25	23.07	3.50	-2.45	-0.03	0.13	6.85	-0.15
	E8	Winter	25.96	10.21	7.18	15.21	3.55	5.88	-3.04	-1.16	3.27	-0.15
	E8	Spring	16.35	14.71	8.57	21.24	1.20	-0.79	5.68	0.25	4.89	-1.50
	E8AE	Year										

Location	Pond	Season	Salinity (ppt)	DO (mg/L)	pH	Temp (C)	Staff gauge (ft)	Salinity (ppt)	DO (mg/L)	pH	Temp (C)	Staff gauge (ft)
Eden	E8AE	Fall										
Landing	E8AE	Winter										
	E8AE	Spring										
	E8AW	Year										
	E8AW	Fall										
	E8AW	Winter										
	E8AW	Spring										
	E8XN	Year	23.38	9.28	8.05	17.42	5.83	0.11	1.05	0.22	2.10	0.06
	E8XN	Fall	31.48	8.79	7.89	20.00	6.25	-4.85	2.55	-0.11	-1.90	0.55
	E8XN	Winter	23.44	8.66	7.87	13.06	6.25	2.24	-0.76	0.35	2.79	-0.05
	E8XN	Spring	15.23	10.40	8.38	19.20	5.00	2.93	1.36	0.40	5.40	-0.30
	E8XS	Year	21.75	9.24	8.00	16.19	6.33	-1.15	0.81	0.05	0.77	0.91
	E8XS	Fall	30.70	7.96	7.82	18.11	6.85	-5.63	1.57	-0.27	-4.02	0.95
	E8XS	Winter	21.76	9.59	8.02	12.81	7.65	1.67	-0.23	0.23	2.33	1.30
	E8XS	Spring	12.78	10.16	8.15	17.64	4.50	0.48	1.09	0.19	3.99	0.50
	E9	Year	23.54	9.84	8.15	16.50	6.02	-1.68	0.65	0.31	-0.20	-0.15
	E9	Fall	31.30	8.84	7.92	18.82	7.00	-5.39	1.07	-0.20	-3.58	1.05
	E9	Winter	22.37	9.19	7.97	12.75	7.05	1.53	-0.88	0.84	2.84	0.05
	E9	Spring	16.96	11.47	8.55	17.92	4.00	-1.16	1.76	0.28	0.15	-1.55
Mowry	M1	Year	87.51	7.43	8.31	19.88	2.12	20.23	-1.02	0.03	2.98	-1.48
	M1	Fall	99.33	7.42	8.07	22.65	1.50	54.57	-0.03	-0.14	1.55	-1.80
	M1	Winter	69.44	8.78	8.45	14.86	2.00	23.36	-1.96	0.04	5.35	-2.00
	M1	Spring	93.77	6.10	8.41	22.13	2.80	-17.22	-1.06	0.18	2.04	-1.00
	M2	Year	87.73	7.40	8.30	19.58	3.42	18.79	-1.43	-0.04	1.92	-0.10
	M2	Fall	101.87	7.28	8.02	22.58	2.80	52.28	-1.63	-0.30	1.34	-0.45
	M2	Winter	69.08	8.79	8.45	14.79	3.20	22.61	-2.13	0.01	4.25	-0.70
	M2	Spring	92.25	6.11	8.44	21.37	4.15	-18.51	-0.55	0.17	0.18	0.45
	M3	Year	153.04	7.30	8.03	18.64	2.92	30.64	-0.11	0.05	1.64	-0.58
	M3	Fall	176.88	8.14	7.69	19.96	1.35	62.26	1.13	-0.21	-1.24	-1.35
	M3	Winter	114.88	10.44	8.39	14.58	4.00	13.30	1.84	0.31	2.63	0.20
	M3	Spring	167.38	3.32	8.00	21.37	3.95	16.38	-3.31	0.03	3.51	-0.05
	M4	Year	209.06	5.49	7.71	19.37		67.00	-1.98	-0.15	0.90	
	M4	Fall	245.00	4.32	7.33	23.66		99.33	-3.15	-0.36	-0.89	
	M4	Winter	208.17	10.53	7.61	14.72		76.17	1.39	-0.42	2.76	
	M4	Spring	174.00	4.14	8.14	19.74		25.50	-1.67	0.28	0.84	
	M5	Year	226.00	4.39	7.59	19.88	3.30	61.78	-2.70	-0.19	1.81	0.65
	M5	Fall	278.33	3.89	7.27	23.24	1.70	89.66	-2.70	-0.25	-0.46	-0.95
	M5	Winter	208.00	7.84	7.51	16.53	3.25	56.33	-0.49	-0.43	4.87	
	M5	Spring	191.67	3.17	7.95	19.86	5.00	39.34	-3.18	0.07	1.00	
	M6	Year	222.00	5.79	7.77	17.89	1.90	40.11	-2.04	0.06	-0.74	-1.82
	M6	Fall	292.67	5.55	7.19	19.45	1.90	61.50	0.67	-0.10	-5.13	-0.80
	M6	Winter	186.83	8.09	8.09	11.56		26.33	-3.13	0.18	-0.50	

Location	Pond	Season	Salinity (ppt)	DO (mg/L)	pH	Temp (C)	Staff gauge (ft)	Salinity (ppt)	DO (mg/L)	pH	Temp (C)	Staff gauge (ft)
Mowry	M6	Spring	186.50	3.73	8.05	22.67		32.50	-3.65	0.12	3.41	
Ravenswood	R1	Year	26.33	8.18	8.28	16.09		-0.44	-1.57	0.00	-1.11	
	R1	Fall	31.18	7.03	7.95	21.39		-7.28	-3.91	-0.29	-3.83	
	R1	Winter	26.47	8.79	8.34	9.64		3.09	-1.13	0.10	-1.06	
	R1	Spring	21.35	8.72	8.54	17.25		2.88	0.32	0.17	1.57	
	R2	Year	171.15	5.88	7.81	17.01	1.40	46.79	-3.49	-0.12	-2.77	-0.48
	R2	Fall	281.33	7.71	7.22	24.00	0.00	40.33	-2.45	0.20	-5.16	
	R2	Winter	84.11	6.18	8.15	10.21	1.40	33.13	-3.30	-0.20	-2.11	-0.30
	R2	Spring	148.00	3.75	8.04	16.81	2.10	66.90	-4.70	-0.38	-1.05	0.05
	R3	Year	113.76	6.45	7.10	19.05		-6.69	-1.61	-0.20	4.12	
	R3	Fall	264.00	0.96	4.48	28.33		70.33	-5.82	-2.23	13.71	
	R3	Winter	100.52	5.74	7.17	11.57		32.30	-4.58	-0.74	-1.70	
	R3	Spring	45.26	9.54	8.38	18.14		-90.83	2.45	1.12	1.25	
	R4	Year	136.08	8.61	7.70	19.36		64.99	0.43	-0.32	4.55	
	R4	Fall	229.59	4.76	6.82	21.54		120.76	-1.55	-0.72	7.30	
	R4	Winter	158.56	10.19	7.89	18.63		112.18	1.22	-0.30	5.10	
	R4	Spring	20.09	10.86	8.38	17.92		-37.97	1.61	0.06	1.25	
	R5	Year	37.51	7.72	7.38	21.07		-32.22	-0.79	-0.30	4.81	
	R5	Fall		2.46	5.62	26.49			-3.61	-0.85	8.04	
	R5	Winter	32.86	10.60	8.04	16.93		14.56	1.45	0.16	3.09	
	R5	Spring	42.16	10.09	8.48	19.80		4.14	-0.23	-0.21	3.31	
	R5S	Year	34.82	8.21	7.26	19.70		-27.77	-0.44	-0.54	2.99	
	R5S	Fall		3.73	5.24	24.96			-0.83	-1.27	5.55	
	R5S	Winter	26.54	9.75	8.09	14.39		7.93	-1.51	-0.06	-0.36	
	R5S	Spring	43.09	11.17	8.44	19.76		5.96	1.02	-0.29	3.78	
	RSF2U1	Year	24.53	12.39	7.78	20.22	5.33	1.36	-3.34	-0.76	0.52	-0.29
	RSF2U1	Fall	29.42	14.70	6.84	26.48	5.65	-6.19	2.71	-1.28	2.73	-0.10
	RSF2U1	Winter	25.41	13.42	8.16	14.32	4.60	6.99	-2.74	-0.45	1.25	-0.95
	RSF2U1	Spring	18.76	9.05	8.34	19.88	5.75	3.29	-9.97	-0.55	-2.40	0.20
	RSF2U2	Year	24.84	12.60	7.84	18.92	5.88	1.43	-0.70	-0.50	1.87	-0.12
	RSF2U2	Fall	30.62	12.70	6.89	25.99	5.85	-4.63	2.63	-1.16	4.14	-0.20
	RSF2U2	Winter	25.34	11.00	8.04	13.06	5.95	5.91	-4.43	-0.28	0.90	0.10
	RSF2U2	Spring	18.58	14.09	8.60	17.71	5.85	3.02	-0.31	-0.05	0.56	-0.25
	RSF2U3	Year	131.36	5.94	7.46	19.28	4.17	8.41	-1.15	-0.38	1.48	-0.36
	RSF2U3	Fall	194.25	4.02	6.24	23.65	3.40	-55.00	-0.84	-1.07	-0.59	0.15
	RSF2U3	Winter	119.22	6.62	7.78	13.71	4.05	59.74	-1.75	-0.19	1.81	-0.70
	RSF2U3	Spring	80.60	7.19	8.38	20.49	5.05	20.49	-0.85	0.15	3.22	-0.55
	RSF2U4	Year	23.94	8.63	7.41	17.55	4.05	0.20	-1.39	-0.82	2.02	0.93
	RSF2U4	Fall	29.13	5.93	6.46	21.82	4.55	-6.25	-1.39	-1.36	2.51	1.75
	RSF2U4	Winter	24.86	9.25	7.26	13.26	4.40	4.84	0.57	-0.72	2.56	1.05
	RSF2U4	Spring	17.81	10.73	8.52	17.56	3.20	1.99	-3.34	-0.38	0.99	0.00

Appendix 7

This appendix presents line graphs (one per set of ponds) of the mean water quality measures during each survey: salinity (Figs. A7.1-A7.4), water temperature (Figs. A7.5-A7.8) dissolved oxygen (Figs. A7.9-A7.12), pH (Figs. A7.13-A7.16), and staff gauge reading (Figs. A7.17-A7.20).

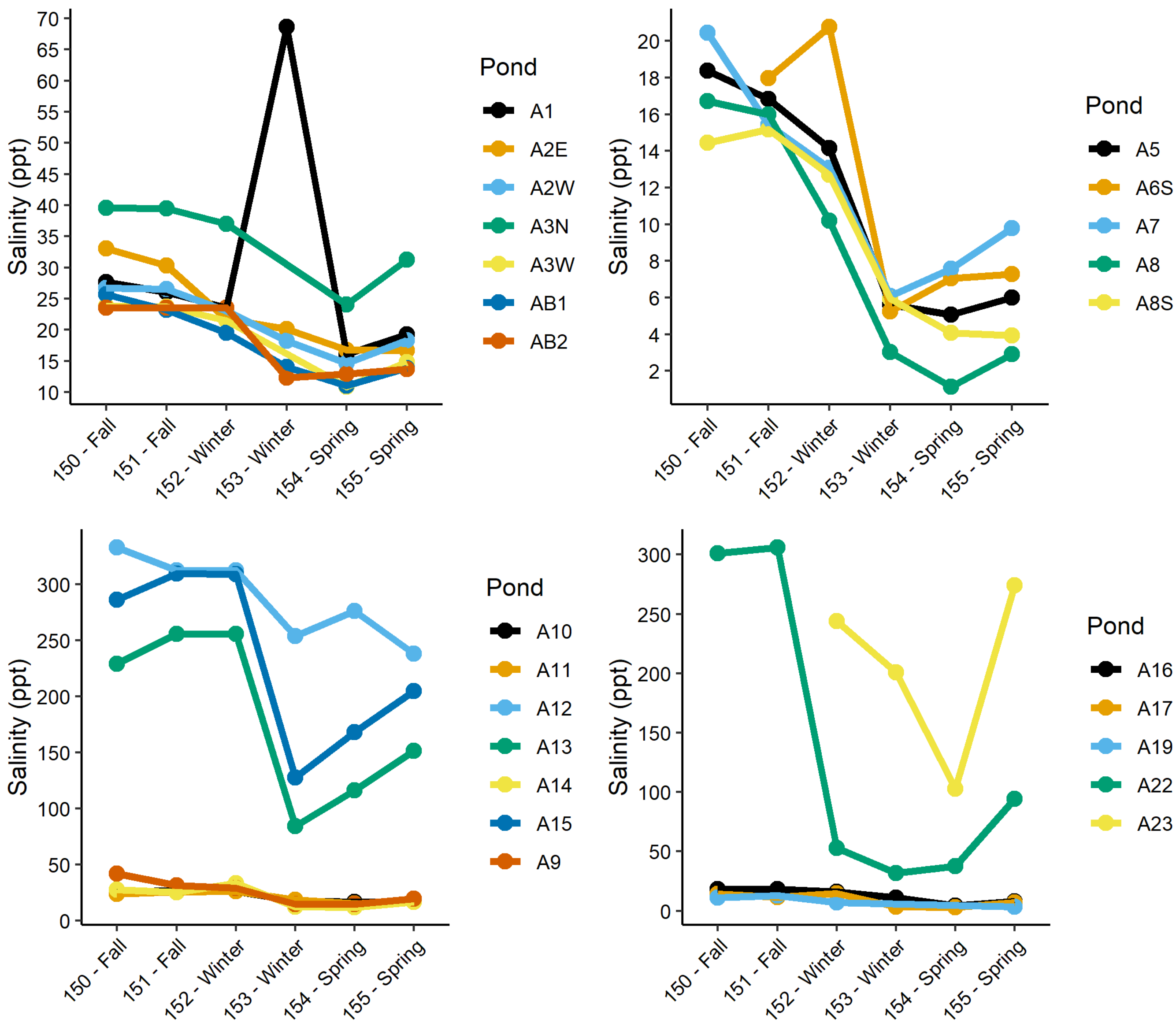


Figure A7.2. Average Salinity (ppt) at the Alviso pond complex, South San Francisco Bay, California; September 2023 – May 2024. Scale differs between graphs.

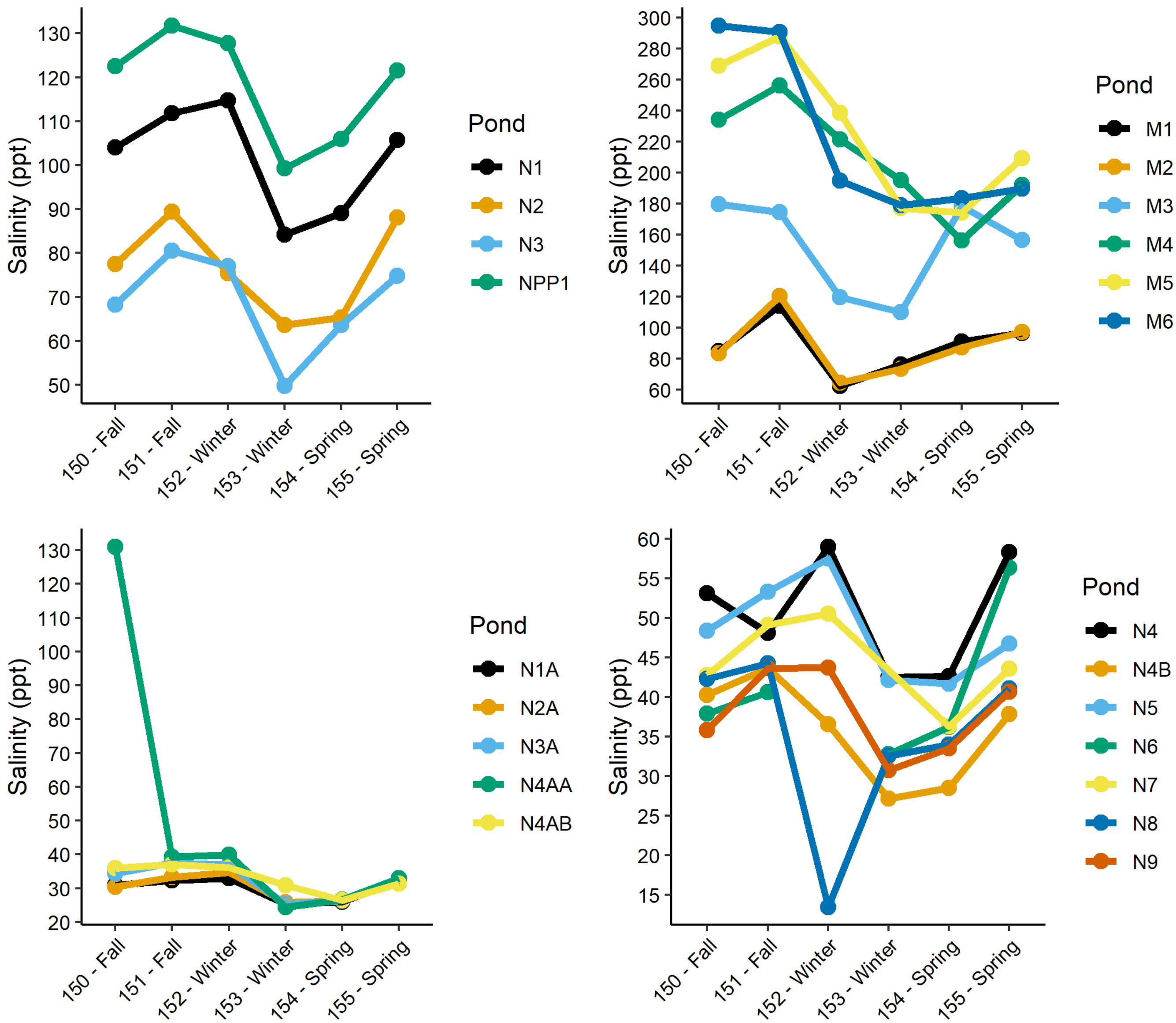


Figure A7.3. Average Salinity (ppt) at the Coyote Hills, Dumbarton, and Mowry pond complexes, South San Francisco Bay, California; September 2023 – May 2024. Scale differs between graphs.

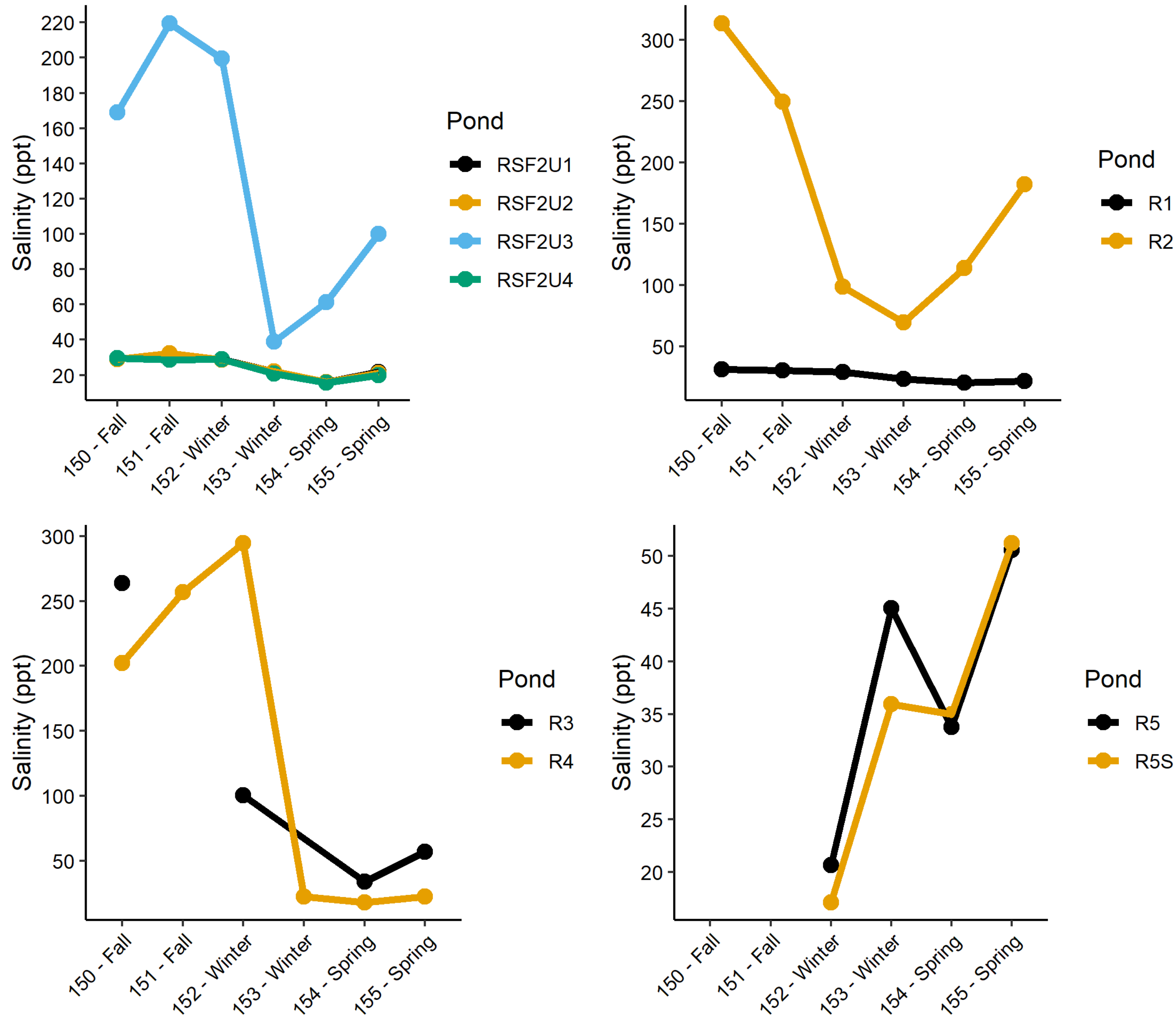


Figure A7.4. Average Salinity (ppt) at the Ravenswood pond complex, South San Francisco Bay, California; September 2023 – May 2024. Scale differs between graphs.

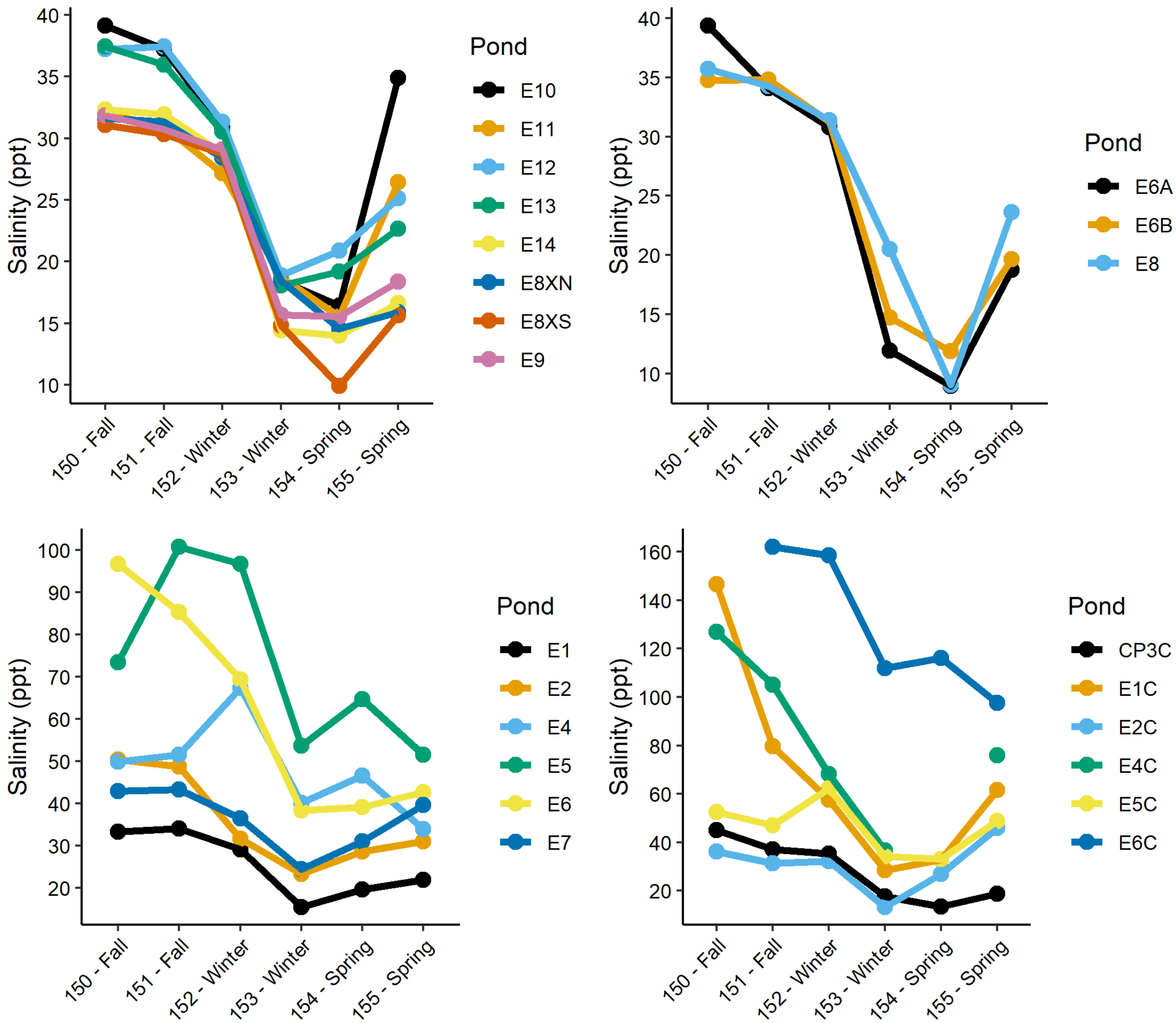


Figure A7.5. Average Salinity (ppt) at the Eden Landing pond complex, South San Francisco Bay, California; September 2023 – May 2024. Scale differs between graphs.

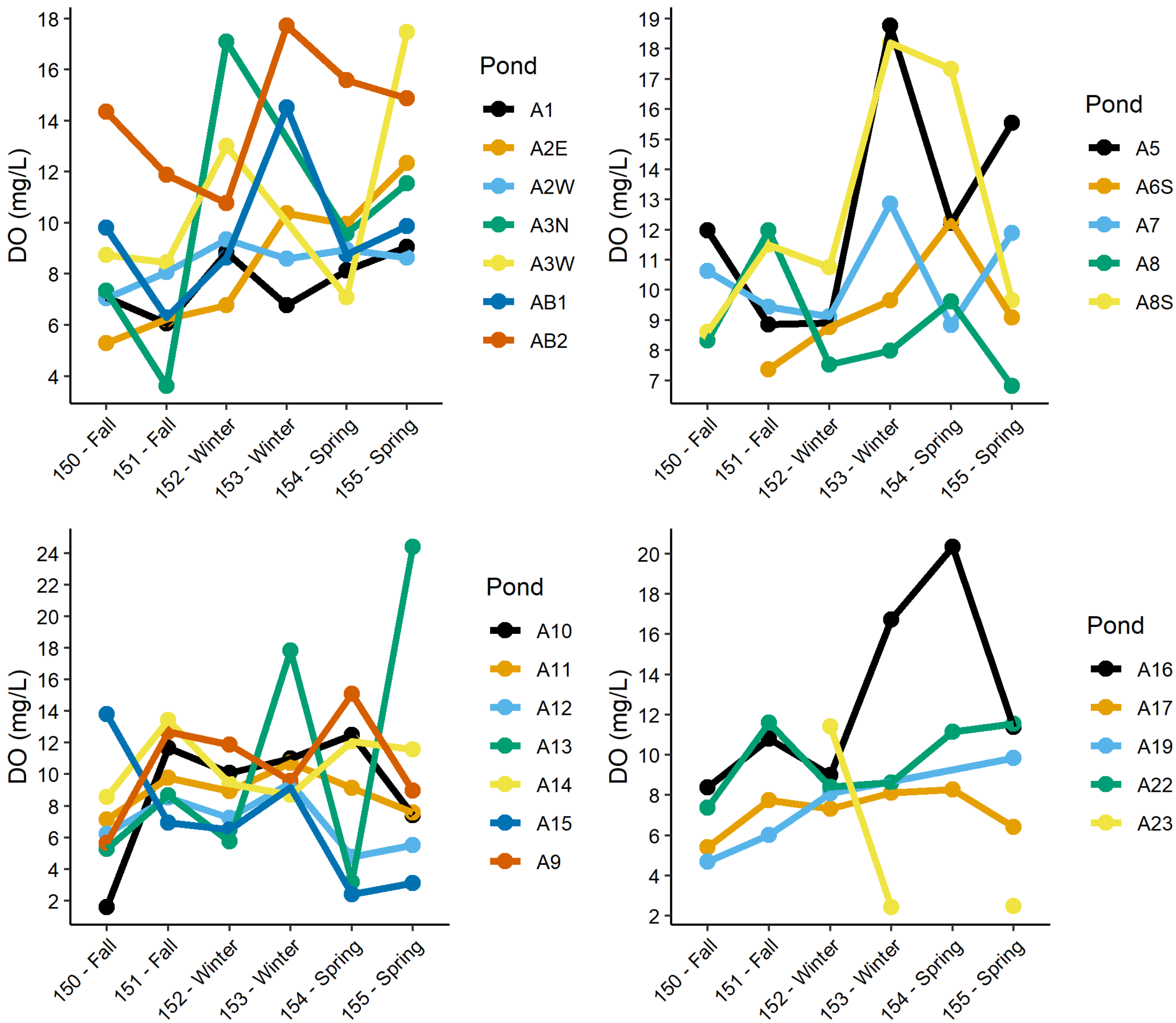


Figure A7.6. Average DO (mg/L) at the Alviso pond complex, South San Francisco Bay, California; September 2023 – May 2024. Scale differs between graphs.

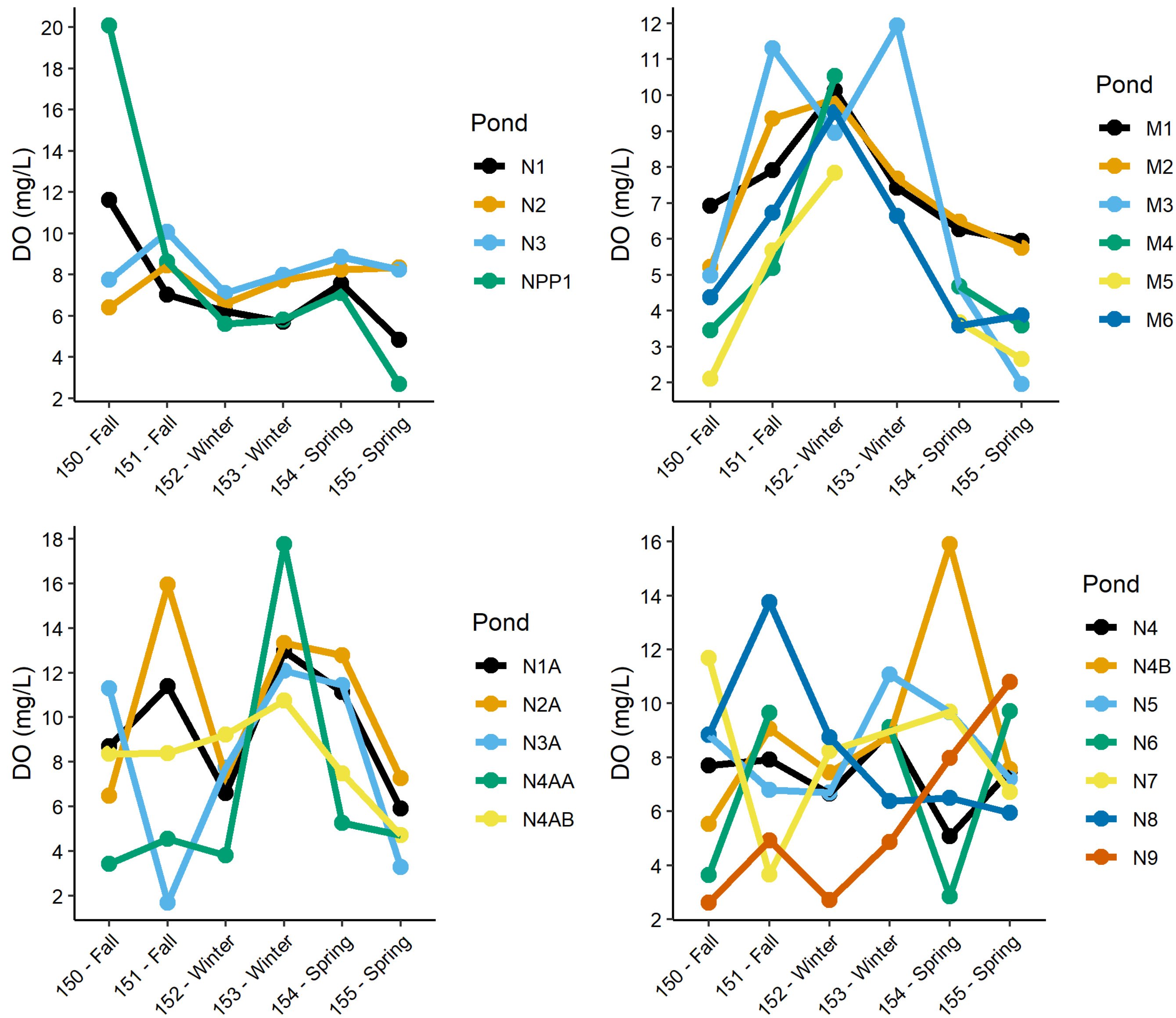


Figure A7.7. Average DO (mg/L) at the Coyote Hills, Dumbarton, and Mowry pond complexes, South San Francisco Bay, California; September 2023 – May 2024. Scale differs between graphs.

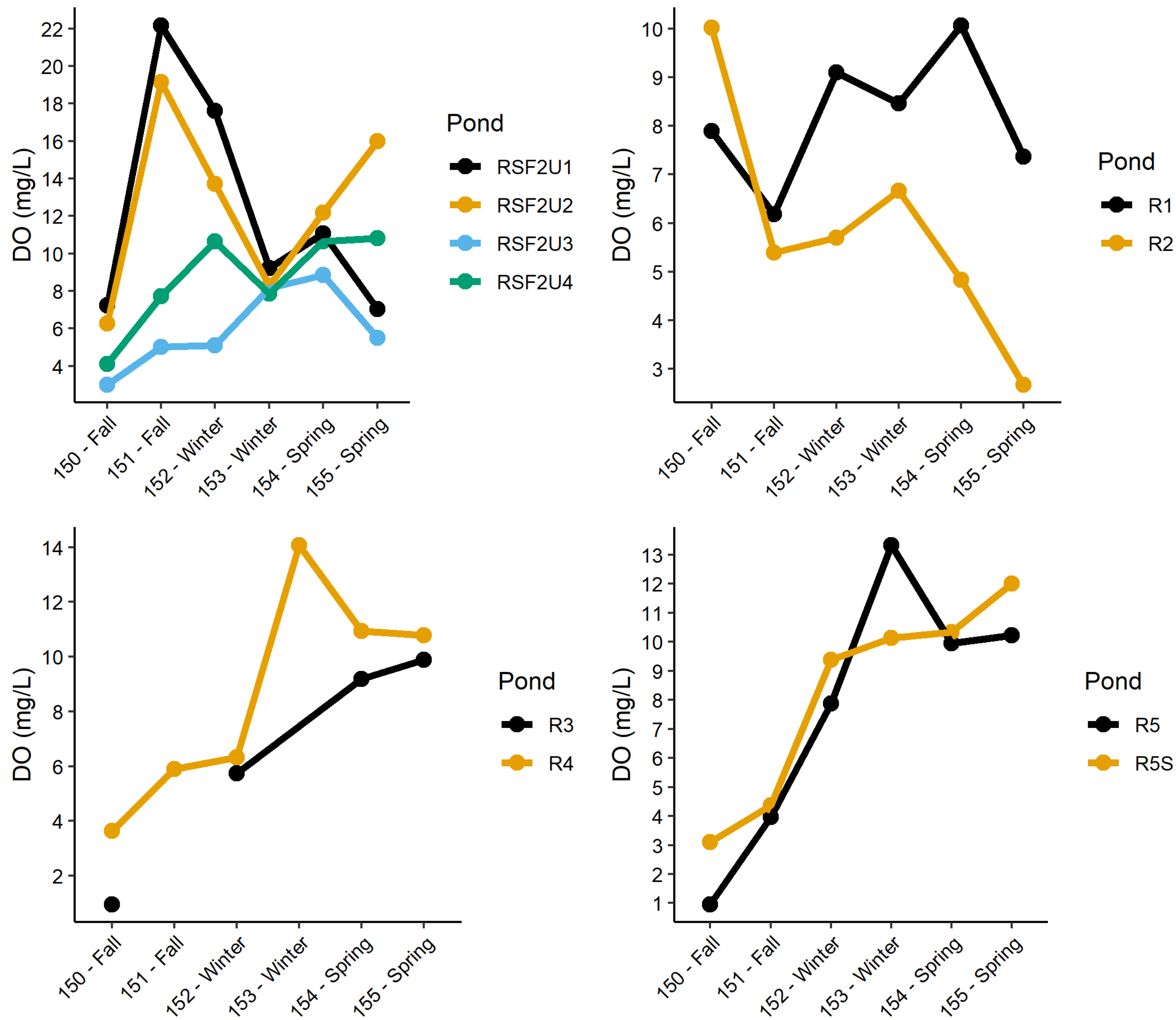


Figure A7.8. Average DO (mg/L) at the Ravenswood pond complex, South San Francisco Bay, California; September 2023 – May 2024. Scale differs between graphs.

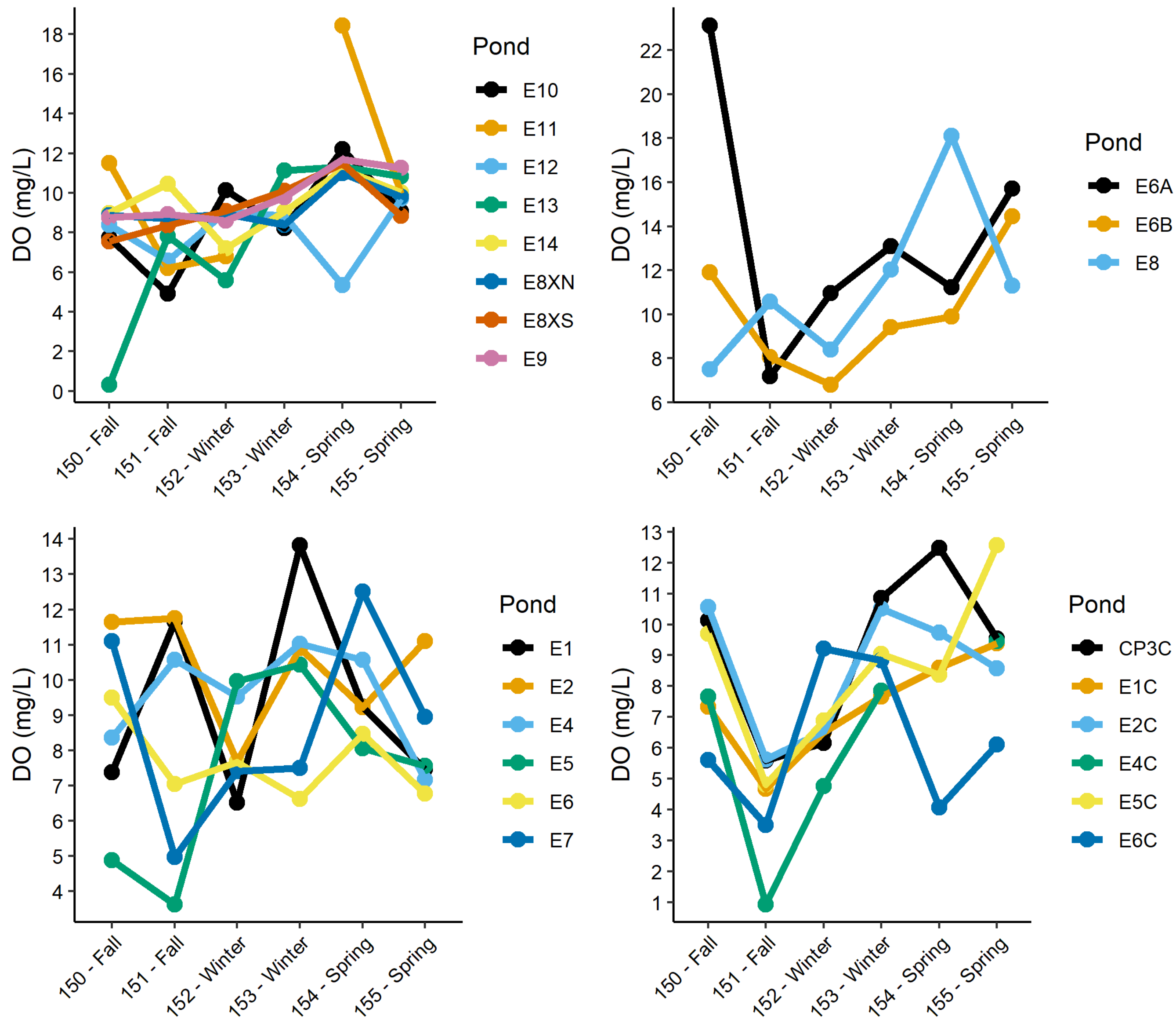
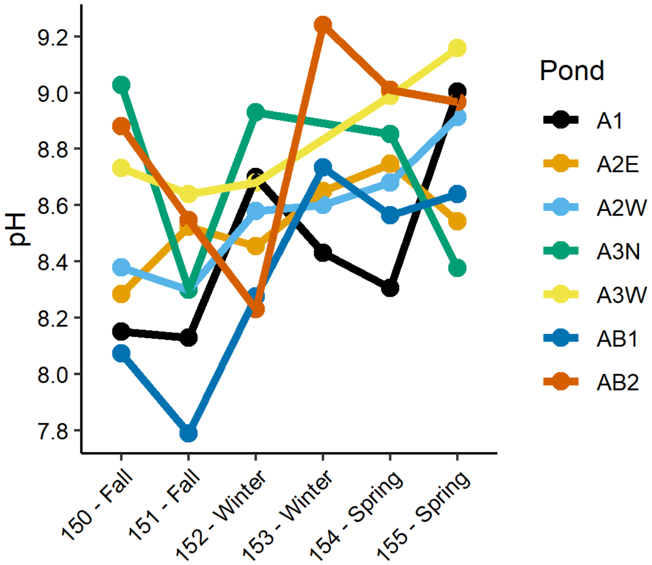
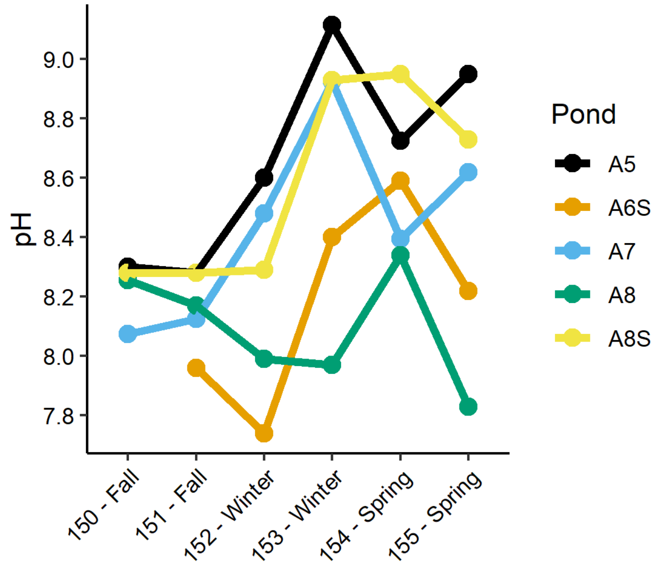
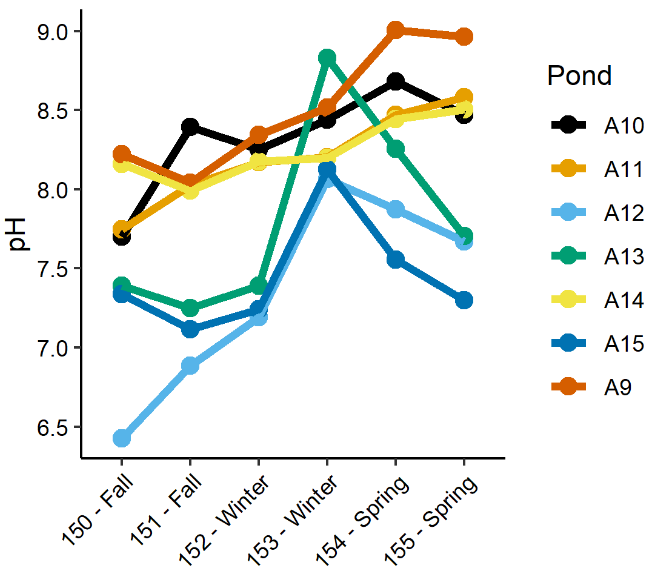


Figure A7.9. Average DO (mg/L) at the Eden Landing pond complex, South San Francisco Bay, California; September 2023 – May 2024. Scale differs between graphs.







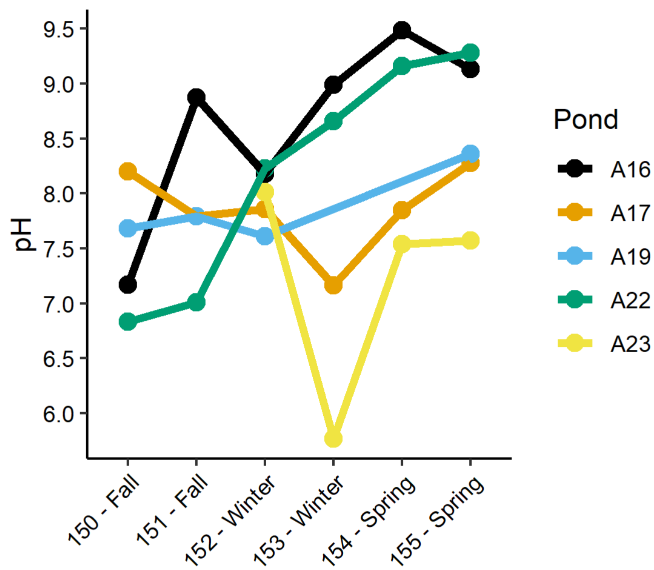


Figure A7.10. Average pH at the Alviso pond complex, South San Francisco Bay, California; September 2023 – May 2024. Scale differs between graphs.

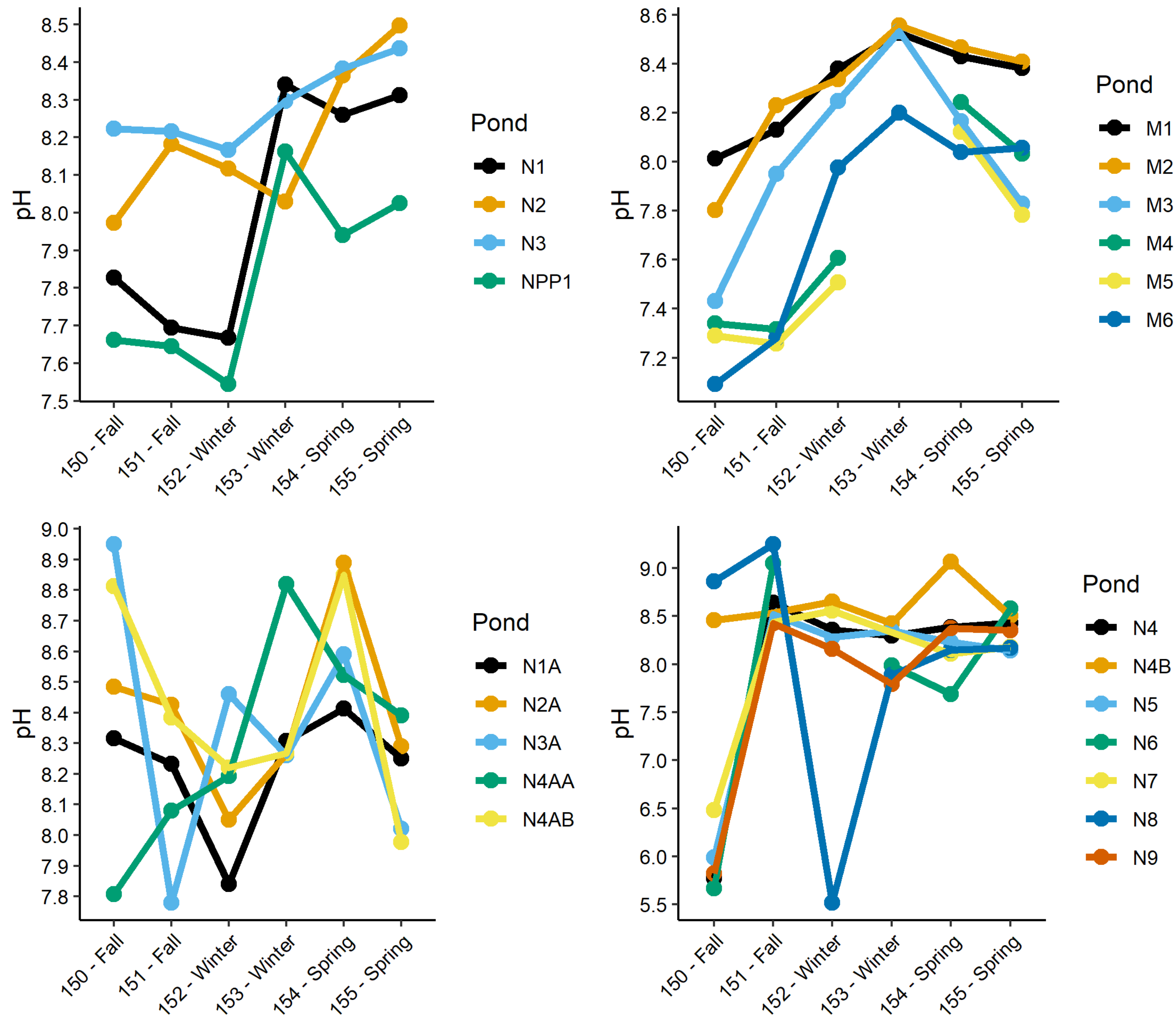


Figure A7.11. Average pH at the Coyote Hills, Dumbarton, and Mowry pond complexes, South San Francisco Bay, California; September 2023 – May 2024. Scale differs between graphs.

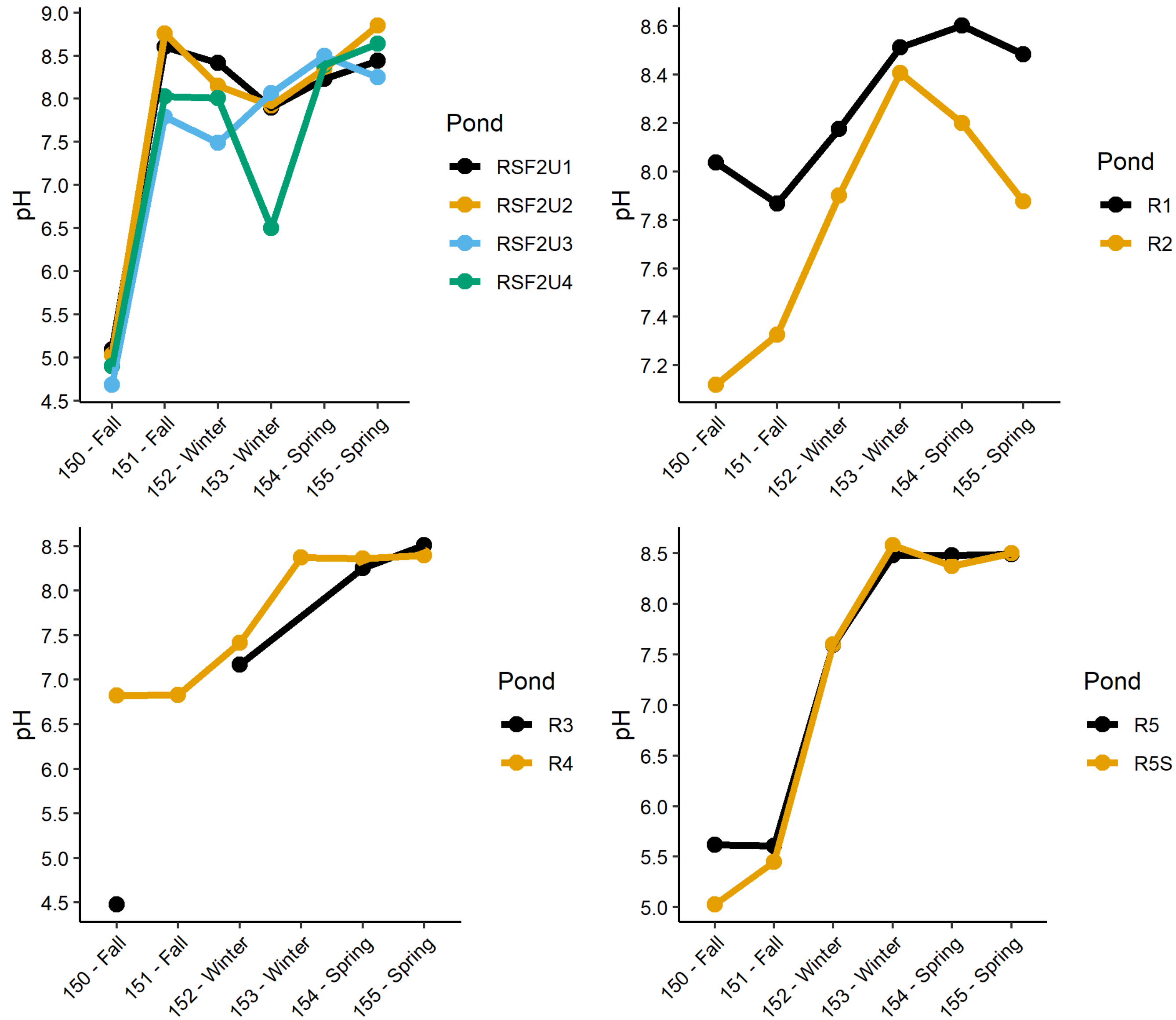


Figure A7.12. Average pH at the Ravenswood pond complex, South San Francisco Bay, California; September 2023 – May 2024. Scale differs between graphs.

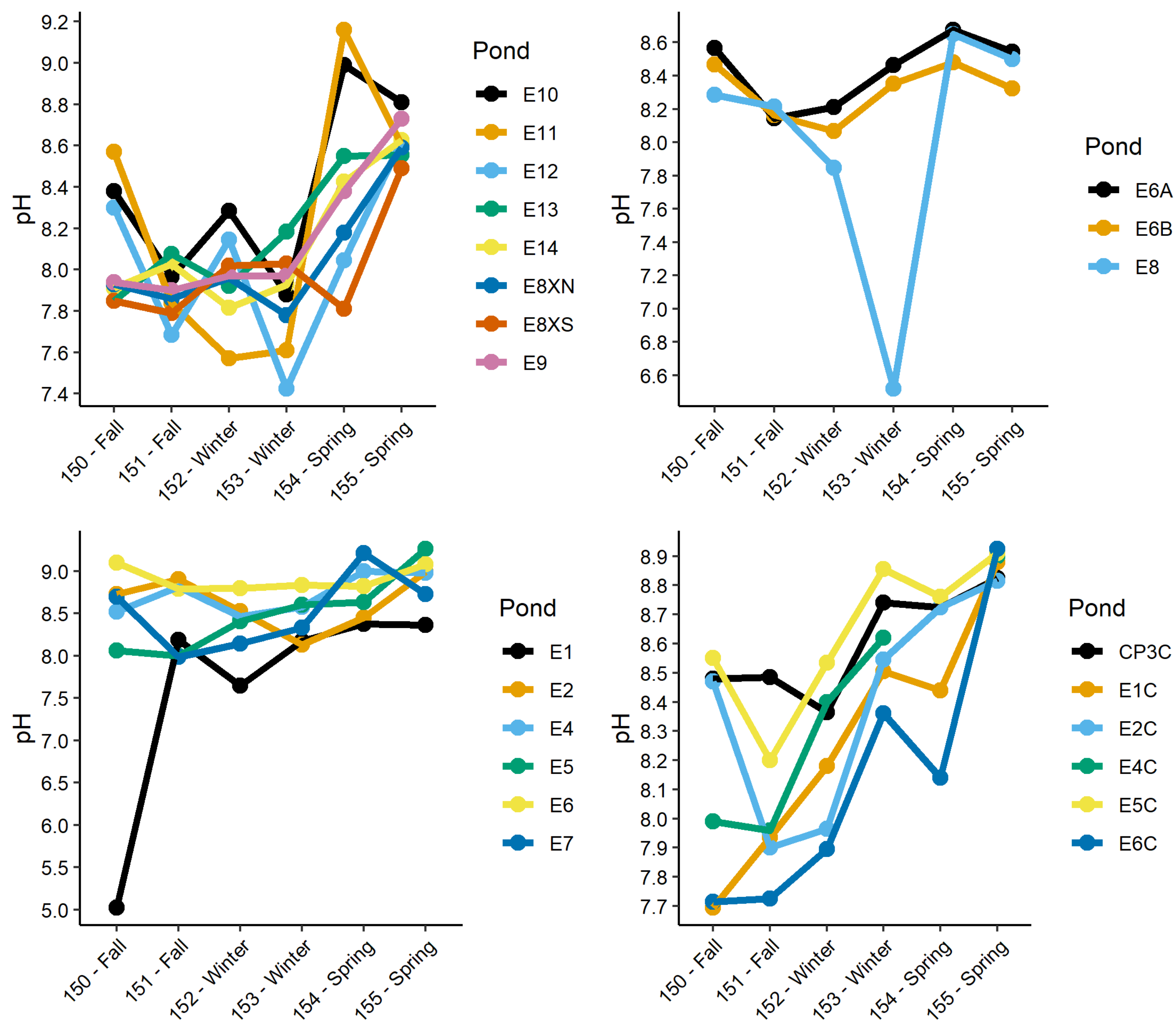


Figure A7.13. Average pH at the Eden Landing pond complex, South San Francisco Bay, California; September 2023 – May 2024. Scale differs between graphs.

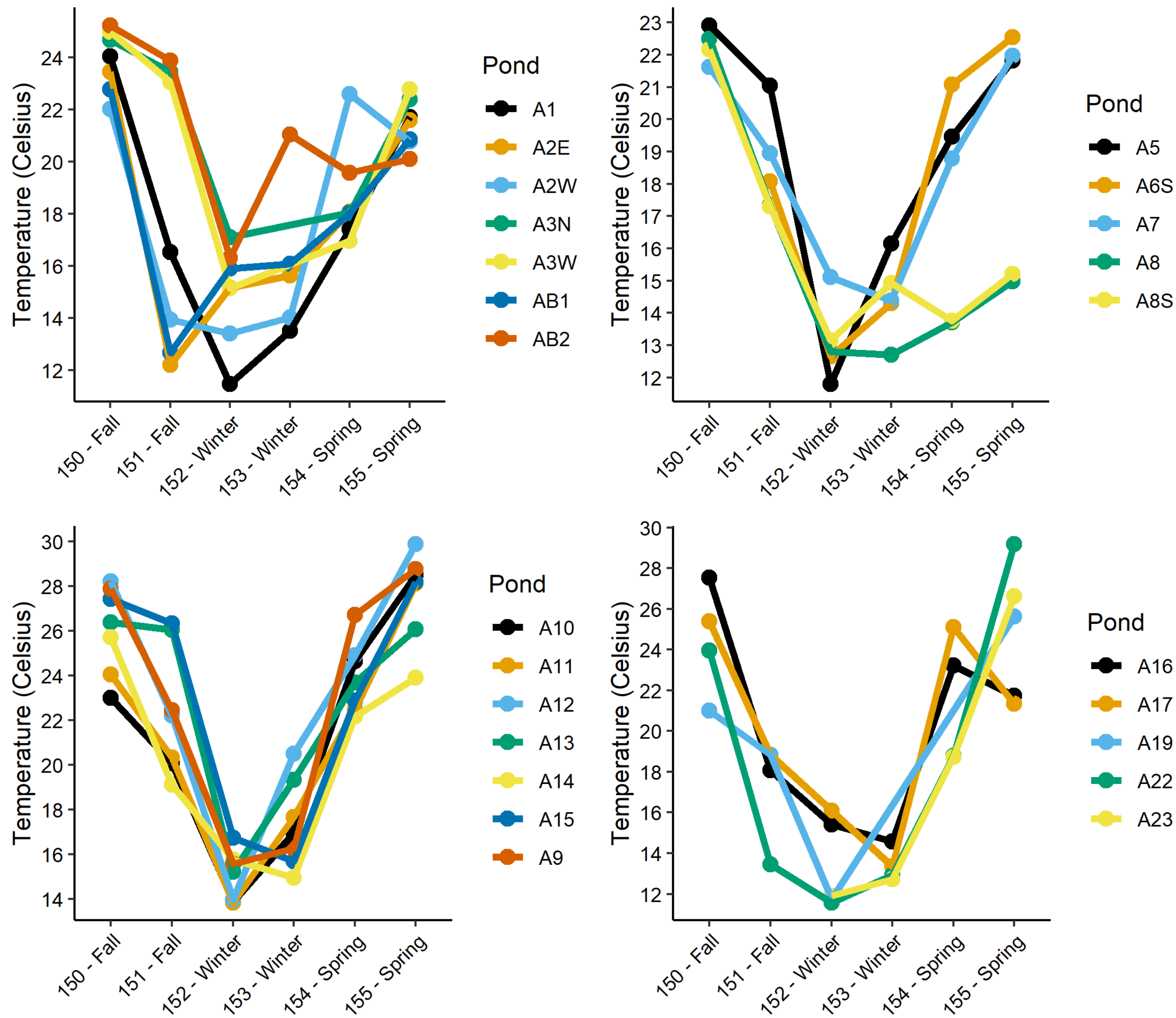


Figure A7.14. Average Temperature (Celsius) at the Alviso pond complex, South San Francisco Bay, California; September 2023 – May 2024. Scale differs between graphs.

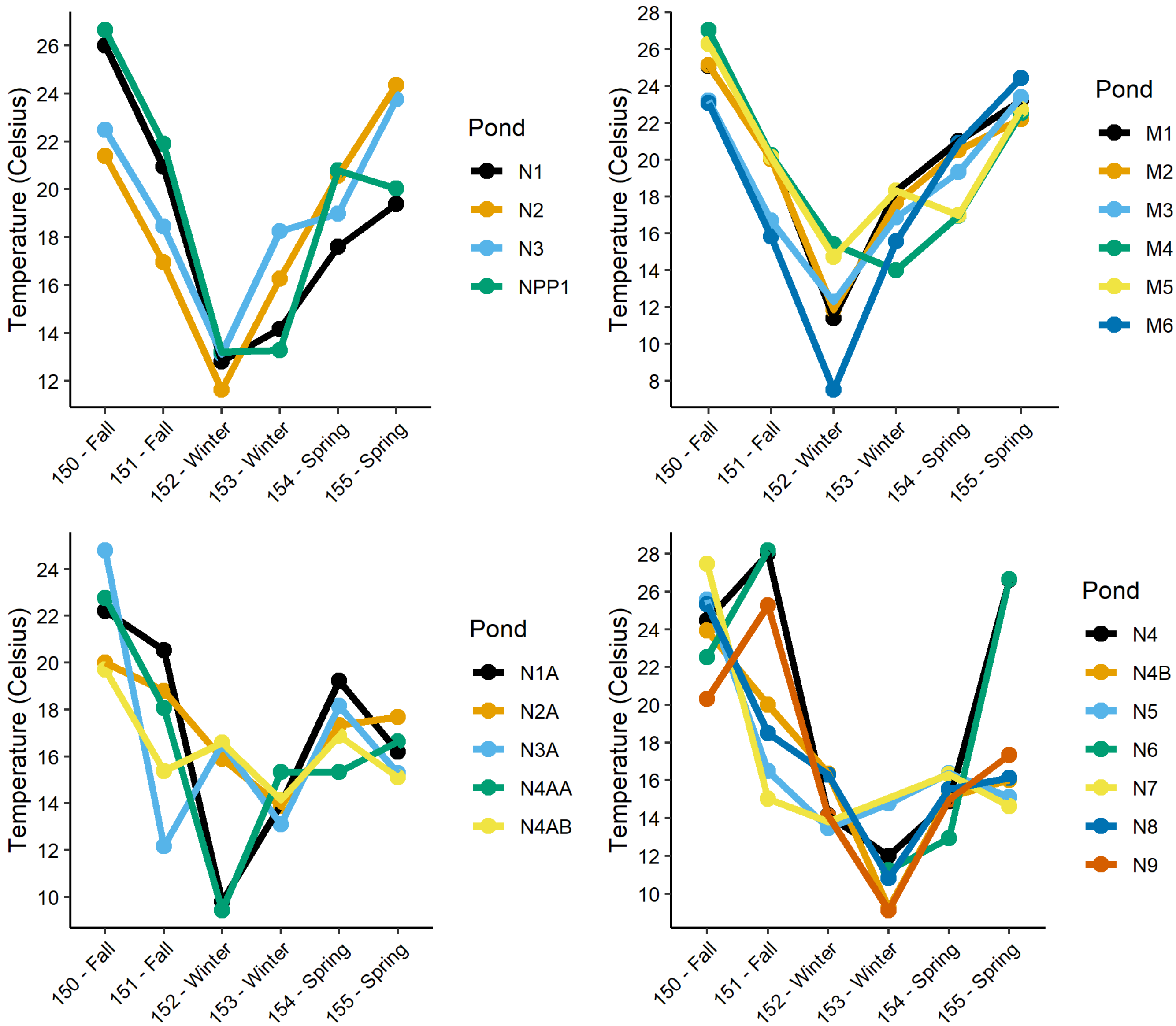


Figure A7.15. Average Temperature (Celsius) at the Coyote Hills, Dumbarton, and Mowry pond complexes, South San Francisco Bay, California; September 2023 – May 2024. Scale differs between graphs.

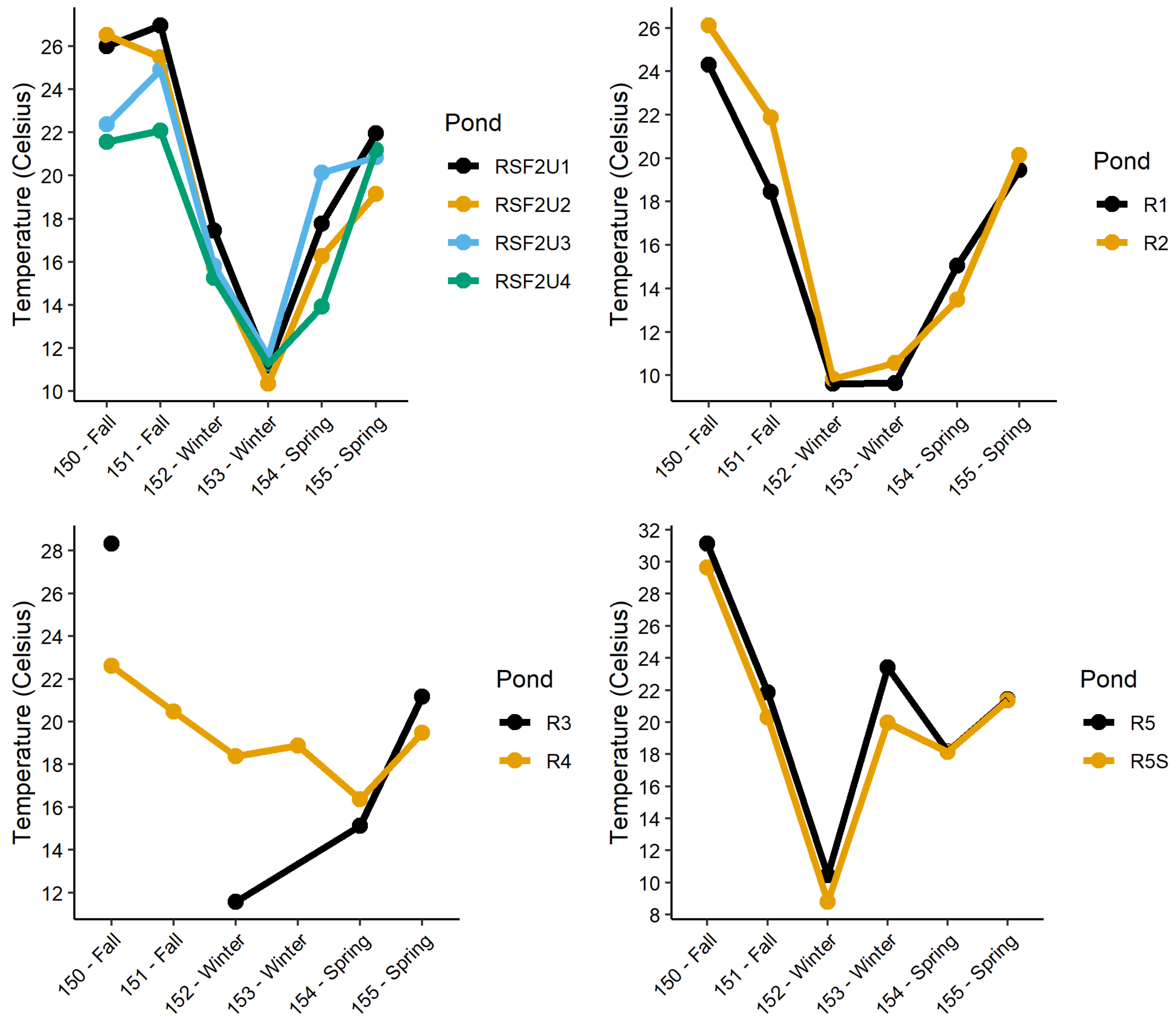


Figure A7.16. Average Temperature (Celsius) at the Ravenswood pond complex, South San Francisco Bay, California; September 2023 – May 2024. Scale differs between graphs.

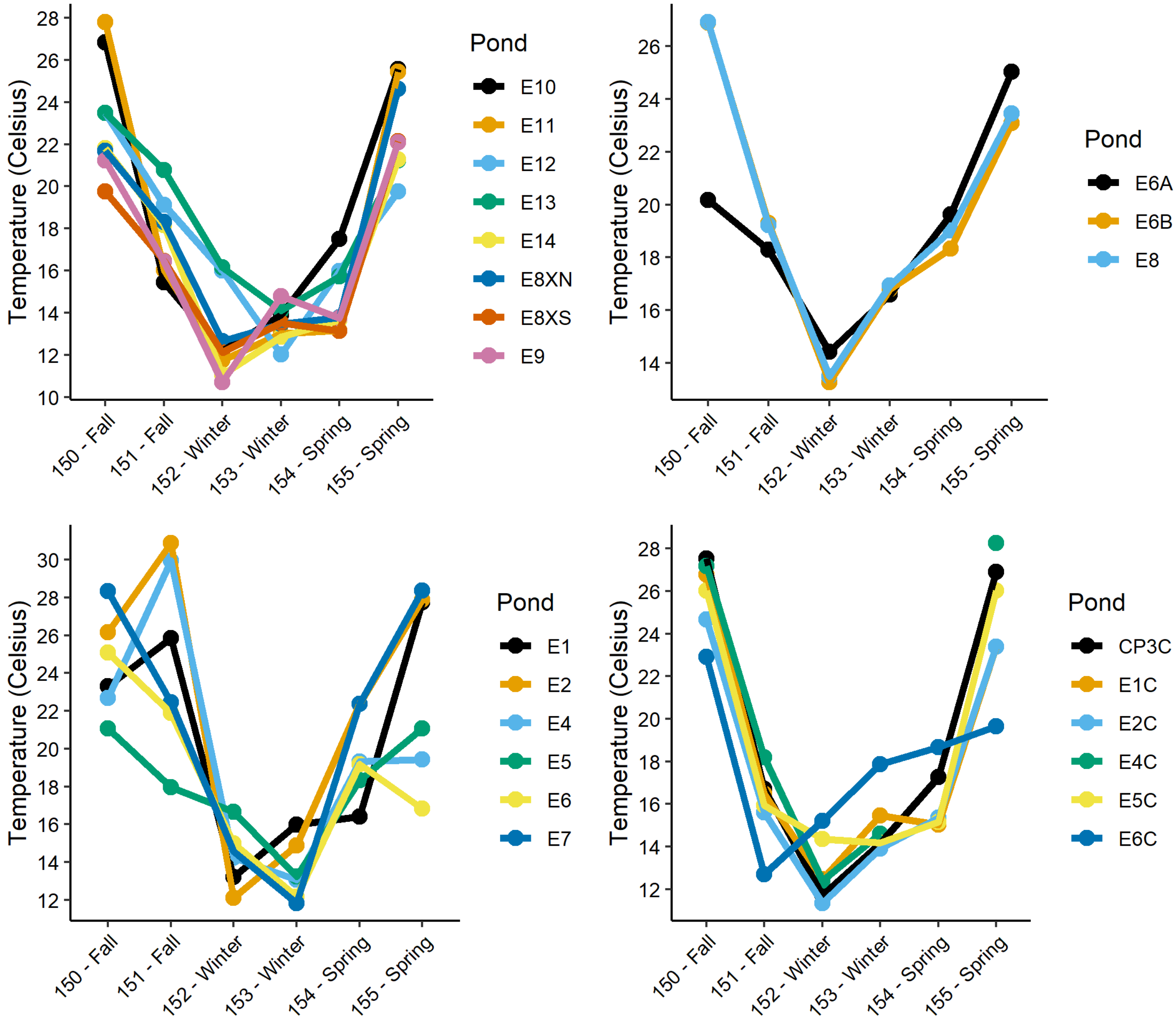


Figure A7.17. Average Temperature (Celsius) at the Eden Landing pond complex, South San Francisco Bay, California; September 2023 – May 2024. Scale differs between graphs.

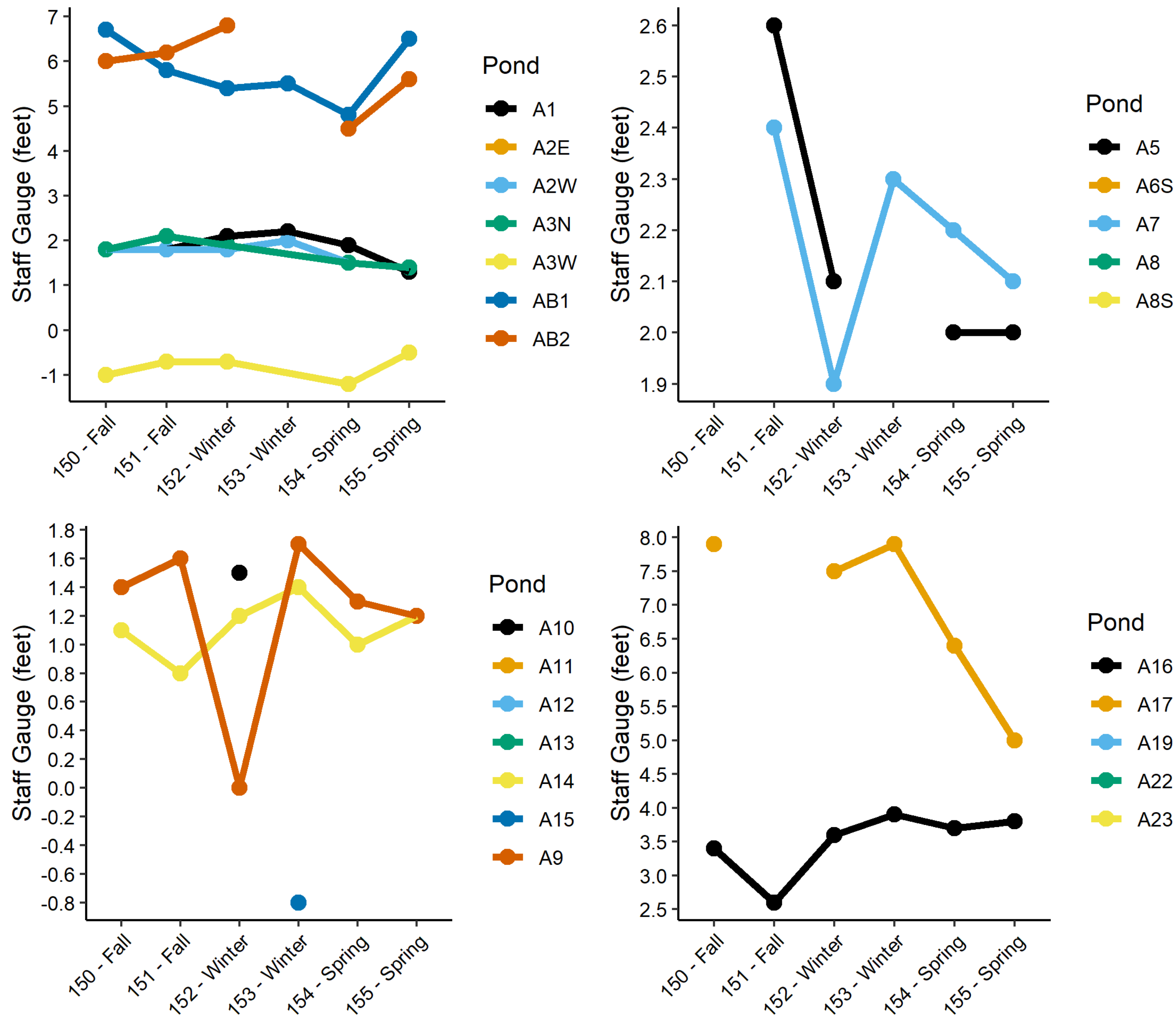


Figure A7.18. Average Staff Gauge (feet) at the Alviso pond complex, South San Francisco Bay, California; September 2023 – May 2024. Scale differs between graphs.

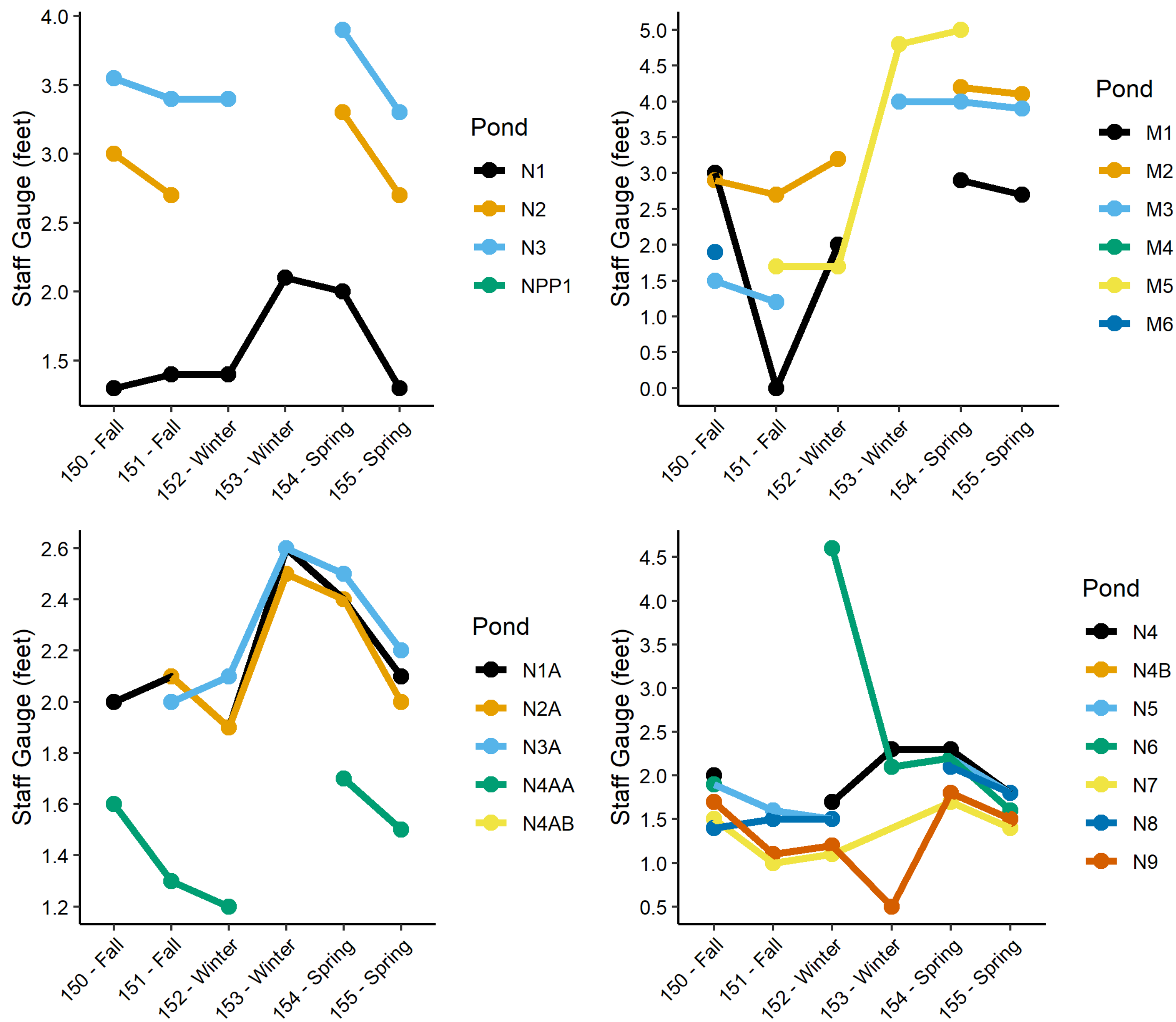


Figure A7.19. Average Staff Gauge (feet) at the Coyote Hills, Dumbarton, and Mowry pond complexes, South San Francisco Bay, California; September 2023 – May 2024. Scale differs between graphs.

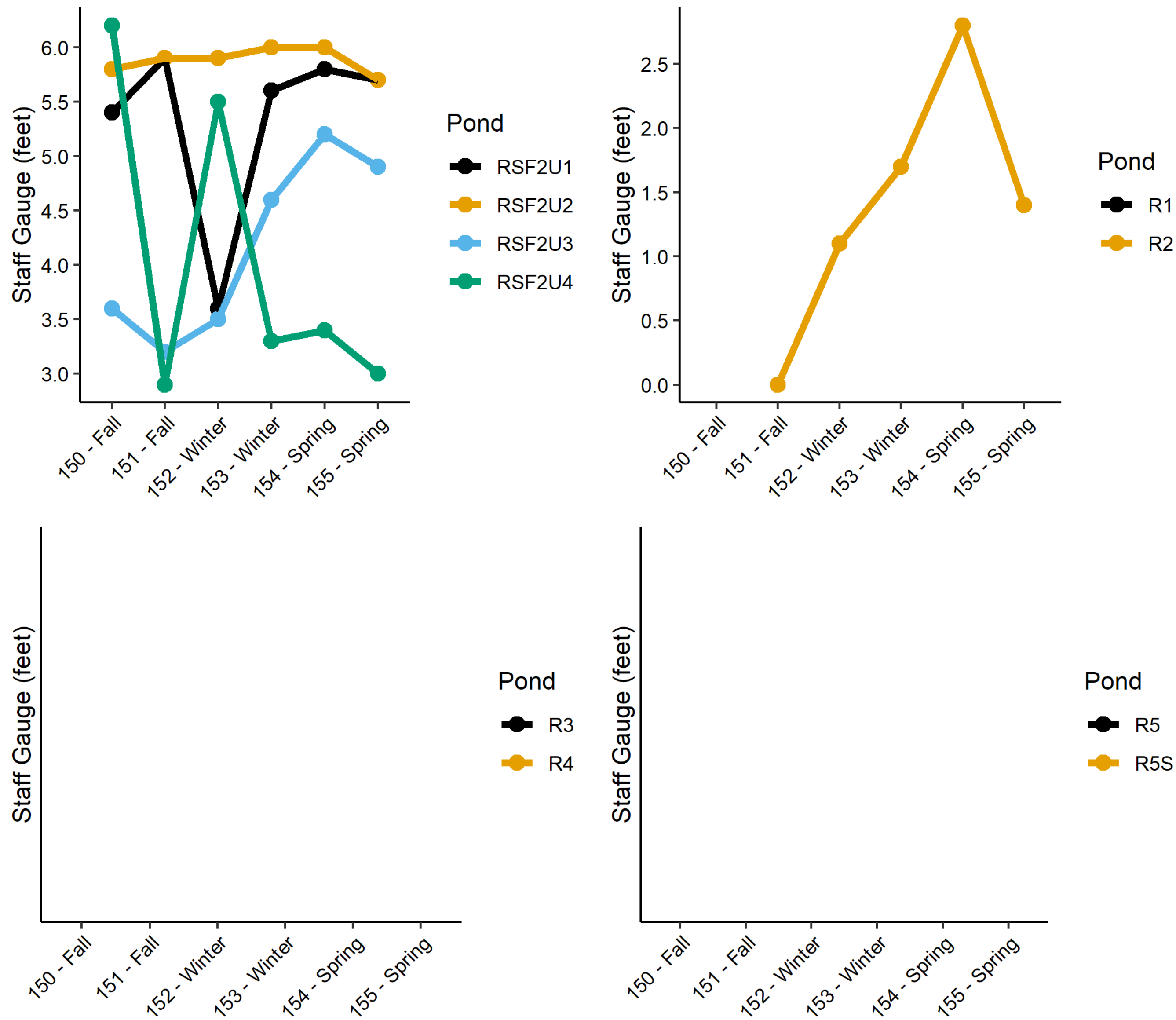


Figure A7.20. Average Staff Gauge (feet) at the Ravenswood pond complex, South San Francisco Bay, California; September 2023 – May 2024. Scale differs between graphs.

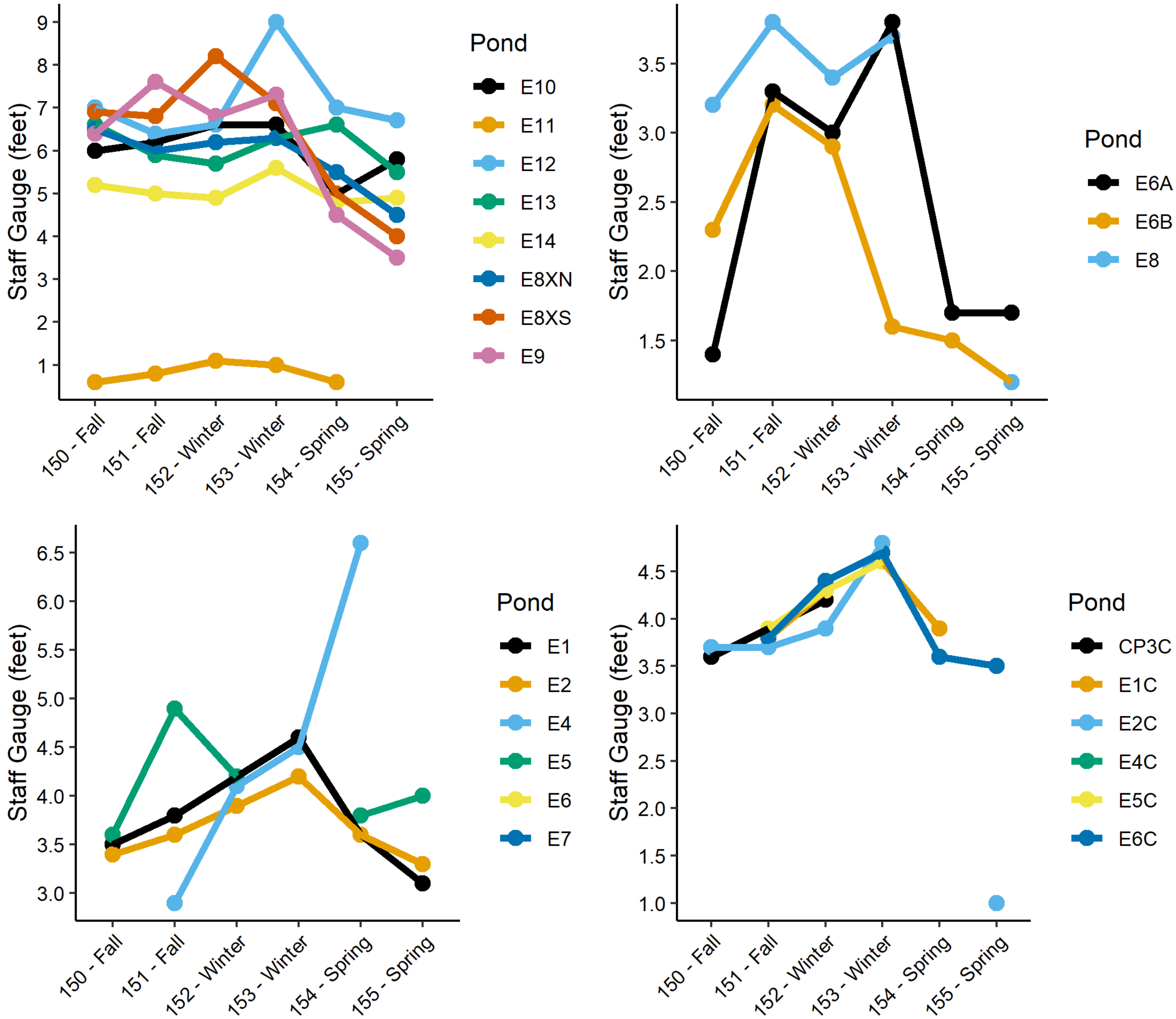


Figure A7.21. Average Staff Gauge (feet) at the Eden Landing pond complex, South San Francisco Bay, California; September 2023 – May 2024. Scale differs between graphs.

Appendix 8

This appendix presents the status of staff gauges within each pond.

Table A8.1. List of all ponds surveyed, their staff gauge location, and staff gauge status in 2024. Ponds marked with a '*' symbol are tidal.

Complex	Pond	Grid	Status	Notes
Alviso	A1	H1	GOOD	
	A10	A2	MISSING	Missing since 10/29/2014
	A11	E1	MISSING	Missing since 10/07/2019
	A12	C5	MISSING	Since at least Fall 2022 the corner is dug out by construction, inaccessible and likely gone
	A13	A2	GOOD	
	A14	A3	OK	Broken below 1.5
	A15	A2	MISSING	
	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 1.7
	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	OK	algae growth under 5.5 ft makes it difficult to read- plastic needs cleaned (Restored as of Fall 2022

Table A8.1. List of all ponds surveyed, their staff gauge location, and staff gauge status in 2024. Ponds marked with a ’*’ symbol are tidal.

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

Table A8.1. List of all ponds surveyed, their staff gauge location, and staff gauge status in 2024. Ponds marked with a '*' symbol are tidal.

Complex	Pond	Grid	Status	Notes
Eden Landing	E1	A1	GOOD	Replaced in 2019
	E10	F2	OK	difficult to read under 6.5 ft. - plastic may just need cleaning
	E11	E3	GOOD	
	E12	D6	OK	Top number is 8ft, algae makes most of it illegible
	E13	C2	OK	Two staff gauges, master is white plastic, cannot read numbers under 6ft due to algae growth
	E14	B1	GOOD	Can read up to 5ft, algae below
	E1C	E3	GOOD	
	E2	D1	GOOD	
	E2C	A2	OK	Broken below 5ft.
	E3C	B2	OK	Broken below 4ft
	E4	B6	GOOD	
	E4C	NONE	MISSING	Missing since at least 2014
	E5	C6	OK	algae growth below 4.2 ft
	E5C	C4	GOOD	
	E6	D8	MISSING	SG removed during construction 2021
	E6A	A3	OK	difficult to read under 4.5ft
	E6B	A6	OK	difficult to read under 2ft
	E6C	A4	GOOD	
	E7	B5	MISSING	Missing as of 12/2020; replacement pending -> still missing 11/2022
	E8	I6	OK	wooden numbers difficult to read unless up close
	E8AE	NONE	MISSING	Tidal pond
	E8AW	NONE	MISSING	Tidal pond
	E8XN	D3	OK	Can read up to 7ft, algae below
	E8XS	D3	OK	Can read up to 7ft, algae below, Tidal pond
	E9	A4	OK	Tidal pond, can read up to 7ft, algae below

Table A8.1. List of all ponds surveyed, their staff gauge location, and staff gauge status in 2024. Ponds marked with a ’*’ symbol are tidal.

Complex	**Pond**	**Grid**	**Status**	**Notes**
Mowry	M1	H10	GOOD	
	M2	G10	OK	4ft is the highest number, but this is often covered in water
	M3	B6	OK	Top number unreadable
	M4	C13	MISSING	Missing as of 2023-11-09 survey
	M5	A3	GOOD	
	M6	B5	MISSING	Missing
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	