Water Quality Status and Trends 2024

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EXECUTIVE SUMMARY

The Texas Coast comprises highly productive ecosystems that provide critical habitat for wildlife in addition to economic benefits to local communities. One key factor that modulates ecosystem health is water quality. Routine water quality assessments can identify locations experiencing water quality degradation and help guide best management practices for improving water quality and overall ecosystem health.

The purpose of this analysis was to provide resource managers with an updated assessment (through 2023) of the current water quality status and long-term trends in the Coastal Bend. Results show generally acceptable water quality conditions across most of the bay systems of the Coastal Bend, but with some areas that require additional scrutiny of future monitoring data and/or management intervention to address apparent water quality degradation. Areas showing apparent water quality degradation include:

- Port Bay in the Aransas Bay complex, as well as Mission River tidal, Aransas River tidal, and Aransas River, all of which are displaying symptoms of nutrient and/or bacterial pollution.

- Redfish Bay, Oso Bay, and the Nueces River tidal segment, all of which are displaying symptoms of nutrient and/or bacterial pollution.

- Baffin Bay and its three tributary streams including Petronila Creek, San Fernando Creek, and Los Olmos Creek, all of which are displaying symptoms of nutrient and/or bacterial pollution.

We recommend that these waterbodies should be prioritized in future funding opportunities for measures such as pollutant source tracking, pollutant load reduction strategies, and similarly related efforts.

INTRODUCTION

The Coastal Bend region of the Texas Coast contains several ecologically and economically important waterbodies. These waterbodies provide critical habitat and nurseries for numerous birds, mammals, fish, and shellfish species, and they support economic activity through tourism and fishing. Maintaining healthy water quality in these coastal ecosystems is essential for supporting biodiversity and the livelihoods of coastal residents.

Coastal waters throughout Texas are experiencing significant pressures due to population growth and land use change, which can lead to increased pollutant loading and reduction in freshwater inflows. Factors such as increased storm frequency and intensity, rising sea levels, and ocean acidification are also a longer-term concern. These stressors can lead to water quality degradation, which in turn harms native wildlife species and the local communities that depend on healthy ecosystems.

A recent assessment of water quality in the Coastal Bend region of Texas was conducted using data collected by the Texas Commission on Environmental Quality's (TCEQ's) surface water quality monitoring (SWQM) program (West & Wetz, 2021). The assessment incorporated data collected through 2019 from 11 marine assessment units (AUs) throughout the Coastal Bend, and it identified several locations experiencing changes in water quality and showing signs of eutrophication, bacterial pollution, and heavy metal contamination (West & Wetz, 2021). To our knowledge, no similar in-depth assessments have been conducted on the streams feeding into these Coastal Bend bays. Thus, the purpose of this project was to provide resource managers with an updated assessment of water quality status and trends in the bays of the Coastal Bend and a first look at conditions in its streams.

METHODS

Data Acquisition and Screening

All data utilized in this study were downloaded from TCEQ's Surface Water Monitoring Program Information System (SWQMIS) database on February 9th, 2025, from the AUs listed in Appendix A. The included AUs are ordered based on geographic location from north to south in Tables A1-A4 and follow the same color scheme throughout all tables and figures in this report: orange represents the San Antonio Bay system, yellow represents the Aransas Bay system, green represents the Corpus Christi Bay system, and blue represents the Upper Laguna Madre system. A total of 71 sampling stations were assessed across 24 TCEQ segments in five Coastal Bend bay systems. Data were subsequently screened and analyzed using R (v4.1.2) (R Core Team, 2021) and RStudio (v2023.06.1+524) (RStudio Team, 2023), unless otherwise noted.

Data were screened based on sampling timeframe and water quality parameters prior to analysis. Only routine (including historical) data were included in the analysis, and stations that were no longer active as of 2023 were excluded. A total of 53 stations were active as of 2023 and therefore incorporated in the analysis.

The parameters included in this study are listed in Table B1 (Appendix B). With the exception of dissolved oxygen (DO), only surface water quality data (with a depth of 0.4 meters or less) were analyzed. DO data were split into two categories: surface DO, which was collected at a depth of 0.4 meters or less, and bottom DO, which was collected at a depth greater than 0.4 meters.

All data stored in the SWQMIS database were subject to quality assurance and control during initial sample collection. To further ensure data validity, data were inspected upon retrieval for anomalies (e.g., negative values where values should be positive, values listed as being right-censored instead of left-censored at the lower limit of detection (LOD), marine enterococci samples listed with freshwater enterococci LODs), and any anomalous datapoints were excluded from the analysis.

A total of 73,193 samples were included after the initial screening steps. Due to the nature of the environmental data, several parameters contained censored data. All samples with a left-censored value (11,481 samples or 15.69%) were replaced with one half of the LOD for the purpose of computing summary statistics. All samples with a right-censored value (504 samples or 0.69%) were replaced with the upper LOD. When applicable, censored statistical tests were employed to account for the censored data without the need to replace left-censored data with one half the LOD.

TCEQ collects samples on an approximate quarterly basis. To avoid biasing the analyses when more than one sample was collected in a single season, all samples collected in the same season were averaged (arithmetic mean) together. Seasons were defined as such: Winter: December, January, February; Spring: March, April, May; Summer: June, July, August; Fall: September, October, November. December samples were classified as "Winter" samples of the calendar year following collection. After aggregating seasonal data, a total of 52,459 samples were utilized in future calculations.

Three-Year Means

To assess the current status of water quality in each waterbody, summary statistics were calculated for all parameters at each station. For the purpose of calculating means, all left-censored data were replaced with one half of the LOD. Tables showing summary statistics results are shown in Appendix C. Each table follows the same color scheme listed previously for the bay systems (*see* Data Acquisition and Screening above). The geometric and arithmetic means were calculated based on data from 2021-2023; the percentages of samples exceeding screening criteria were calculated based on data from 2017-2023 (*see* Seven-Year Exceedances below); the long-term trends were calculated over the entire period of record, as long as the earliest data were collected prior to 2014 (*see* Long-term Trends below). Additionally, parameters that exceeded their screening criteria in over 20% of samples are highlighted in red.

Seven-Year Exceedances

The parameters with established screening criteria (TCEQ, 2024b) are shown in Table B1 (Appendix B). Following TCEQ's seven-year assessment period, data collected from 2017 through 2023 were assessed for screening criteria exceedances. Exceedances for each parameter are shown in Appendix C.

Long-Term Trends

Boxplots showing the results for each parameter at each station (over the entire period of record) are shown in Appendix D (*see* Data Acquisition and Screening above for color scheme). Empty boxplots represent stations without data for that particular water quality parameter. Additionally, stations where parameters had been sampled prior to 2014 were considered to have at least 10 years of data. These stations and parameters were assessed for long-term trends (i.e., trends over the entire period of record) using a censored Kendall's tau correlation coefficient (cenken command from the NADA package) (Lee, 2020). The nonparametric, censored Kendall's tau was chosen due to the large number of censored data and the highly-skewed distributions of the majority of parameters (as determined by data distribution visualization via histograms). The cenken test required left-censored data to be replaced with the LOD rather than half the LOD, which was used for computing summary statistics (*see* Three-Year Means above). Results were considered statistically significant when $p<0.05$; a positive tau indicated an increasing trend over time and a negative tau indicated a decreasing trend over time.

Spatial Interpolation

Spatial interpolation maps (shown in Appendix E) were generated for each parameter with sufficient data using ArcGIS Pro version 10.8 (ESRI, 2024). The maps display the current status (i.e., three-year geometric mean) and the long-term trends (i.e., increasing, decreasing, no trend) at every station with data available. The Spline with Barriers method was used to interpolate a raster surface using a minimum curvature spline technique, based on the three-year geometric means at each station. Although the geometric and arithmetic means were often similar throughout the study, the geometric mean was chosen to represent the current status of each parameter at each station, as it is more robust to outliers, right- or left-skewed data, and censored values.

RESULTS AND DISCUSSION

Results show generally acceptable water quality conditions across most of the bay systems of the Coastal Bend, but with some areas that require additional scrutiny of future monitoring data and/or that require management intervention to address apparent water quality degradation. Rather than synthesize the status and trend for each water quality parameter at each sampling location, here we report on those locations where one or more parameters was indicative of potential water quality degradation. The reader is encouraged to view Appendices C, D, and E at the end of this document for information on specific sites and parameters.

San Antonio Bay system

Mesquite Bay:
Mesquite Bay occasionally had high chlorophyll levels, exceeding the established screening level in 33% of samples, but chlorophyll was stable over time. Surface water DO showed no evidence of impairment, but did have a decreasing trend. Despite enterococci having no exceedances in the timeframe, segment 2463OW (Mesquite Bay oyster waters) was listed on the 2024 Texas 303(d) list of impaired waterbodies due to high bacteria levels (TCEQ, 2024). Oyster waters are assessed

for bacterial contamination via fecal coliforms rather than enterococci, which are used for recreational waters, and the two bacterial groups are not always correlated (Harwood et al., 2005). Nutrients (ammonia, total Kjeldahl nitrogen, nitrite+nitrate, total phosphorus) all displayed decreasing long-term trends, and transparency displayed an increasing trend. Overall, the high chlorophyll and decreasing DO are indicative of a water quality concern, but the decreasing nutrients and increasing transparency indicate improving conditions. Aside from these nutrient indicators, alkalinity showed a decreasing trend over time, although pH was stable.

Recommendation for Mesquite Bay:
Continue monitoring and evaluation of new data is recommended to determine if efforts are needed to address water quality concerns in the future.

Aransas Bay system

The Aransas Bay system included data from multiple bays and streams, including Aransas Bay, St. Charles Bay, Copano Bay (and its tributary, Port Bay), Mission River, Aransas River, and Chiltipin Creek. St. Charles Bay showed no indication of water quality concerns, and only the Port Bay tributary of Copano Bay had multiple indicators point to water quality concerns.

Aransas Bay:
At Aransas Bay station 13402, both alkalinity and pH displayed a long-term decreasing trend. No other water quality concerns were apparent.

Recommendation for Aransas Bay:
Continue monitoring and evaluation of new data is recommended to determine if efforts are needed to address water quality concerns. In particular, process-based studies on the decreasing trend behind the ocean acidification-related parameters noted above should be considered, especially considering that this region is home to populations of calcifying organisms of interest (i.e., oysters) that could be negatively affected by ocean acidification.

Port Bay:
At Port Bay (station 13405), chlorophyll exceeded the screening level in 39% of samples and displayed an increasing trend. Enterococci levels were high on average, exceeding the criteria in 44% of samples, but levels were stable over time. Nitrate levels were likewise very high on average and exceeded the screening level in 50% of samples but showed a decreasing trend. Both surface DO and transparency showed a decreasing trend. Taken as a whole, these indicators suggest that Port Bay is experiencing water quality degradation. In addition to these nutrient indicators, pH showed a decreasing trend. For metals, copper levels exceeded screening levels in 100% of samples collected.

Recommendation for Port Bay:
Steps should be taken to characterize pollutant sources to Port Bay and then to implement best management practices aimed at reducing pollutant loadings. In terms of potential pollutant sources, Port Bay receives stormwater runoff from residential and industrialized areas of Ingleside as well as residential areas in Aransas Pass and Rockport. The influence of septic tanks from rural areas around the bay should also be evaluated.

Mission River:
The Mission River tidal station (12943) displayed occasional high chlorophyll and enterococci levels, exceeding screening levels in 35% and 36% of samples, respectively. Levels of both parameters were stable through time, however. Surface DO levels at that site displayed a decreasing trend. These factors indicate that the tidal segment of the Mission River is likely experiencing water quality degradation. In addition, salinity showed an increasing trend at this location. Further upstream at site 12944, no exceedances of screening levels were observed for any parameter. A decreasing surface DO trend was observed, but decreasing trends in several nutrients (ammonia, nitrate) were also observed.

Recommendations for Mission River:
A total maximum daily load (TMDL) and I-Plan are in place for the Mission River tidal segment (https://www.tceq.texas.gov/waterquality/tmdl/76-mission-aransas.html), which characterize pollutant loadings and offer management recommendations for pollutant load reductions. However, the most recent implementation status update indicates that most of the recommendations have not been implemented due to lack of funding (Schramm et al., 2024). Steps should be taken to support stakeholder efforts to secure funding for implementing the plan. In the upper reaches of the Mission River above the tidal segment, continued monitoring and evaluation of new data is recommended to determine if efforts are needed to address water quality concerns.

Aransas River:
The Aransas River tidal station (12947) displayed high chlorophyll and enterococci levels, which exceeded screening levels in 54% and 33% of samples, respectively. In addition, transparency showed a decreasing trend. In contrast, total Kjeldahl nitrogen and total organic carbon showed a decreasing trend over time. Upstream of this site at station 12948, no exceedances were observed and enterococci displayed a decreasing trend. At the most upstream site (12952), very high nitrate and total phosphorus levels were observed, exceeding screening levels on 70% and 96% of sampling dates. In addition, surface DO and pH showed decreasing trends while total phosphorus showed an increasing trend.

Recommendations for Aransas River:
A TMDL and I-Plan are in place for the Aransas River tidal segment and for a segment further upstream that encompasses station 12952 (https://www.tceq.texas.gov/waterquality/tmdl/76-mission-aransas.html). The I-Plan characterizes pollutant loadings and offers management recommendations for pollutant load reductions. However, the most recent implementation status update indicates that most of the recommendations have not been implemented due to lack of funding (Schramm et al., 2024). Steps should be taken to support stakeholder efforts to secure funding for implementing the plan.

Chiltipin Creek:
Station 12930 on Chiltipin Creek displayed high chlorophyll levels that exceeded the screening level in 50% of samples collected, but levels were stable over time. In addition, selenium and nickel levels exceeded screening levels on 75% and 100% of sampling dates, respectively.

Recommendations for Chiltipin Creek:
Continued monitoring and evaluation of new data is recommended to determine if efforts are needed to address water quality concerns. In addition, it is recommended that additional characterization of metal levels and sources be considered.

Corpus Christi Bay system

The Corpus Christi Bay system included data from Corpus Christi Bay, Nueces Bay, Corpus Christi Inner Harbor, Redfish Bay, Oso Bay, Oso Creek, and the Nueces River.

Corpus Christi Bay:
Of the three Corpus Christi Bay stations, only station 13409 had water quality exceedances. Specifically, copper exceeded screening levels in 75% of samples. The majority of nickel samples were censored (71%), of which 80% had an LOD above the screening criteria, making it difficult to draw conclusions about the current state of nickel. Stations 13409 and 13411 also displayed decreasing alkalinity.

Recommendations for Corpus Christi Bay:
Site 13409 lies adjacent to an area with heavy industrial use. Additional characterization of metal levels and sources should be considered. Because there are few calcifying organisms of interest (i.e., oysters) near to stations 13409 and 13411, process-based studies on the decreasing trend in alkalinity should not be discounted but would be a low priority.

Nueces Bay:
The only station in Nueces Bay (13422) had periodic high chlorophyll that exceeded screening levels on 25% of sampling dates, but chlorophyll was stable over time. Surface dissolved oxygen showed a decreasing trend. These factors indicate that Nueces Bay may be experiencing water quality degradation. However, ammonia and nitrite+nitrate levels showed decreasing trends. Salinity showed an increasing trend in Nueces Bay. Finally, copper exceeded screening levels in 50% of sampling dates. The majority (78%) of nickel samples were censored (i.e., below the LOD), of which 71% had an LOD above the screening criteria, making it difficult to draw conclusions about the status of nickel in this waterbody.

Recommendations for Nueces Bay:
Continued monitoring and evaluation of new data is recommended to determine if efforts are needed to address water quality concerns. In particular, attention should be paid to nutrient-related parameters and salinity, which is a proxy for inflows. In addition, it is recommended that additional characterization of metal levels and sources be considered.

Corpus Christi Inner Harbor:
Corpus Christi Inner Harbor station 13432 had ammonia levels that exceeded screening levels on 50% of sampling dates and nitrite+nitrate levels that exceeded screening levels on 83% of sampling dates. However, levels of ammonia and other related indicators such as chlorophyll, total phosphorus, total Kjeldahl nitrogen, and total organic carbon all showed decreasing trends. Decreasing alkalinity and pH levels were also observed at station 13432. At station 13439, ammonia, chlorophyll, and nitrite+nitrate exceeded screening levels on 33%, 25%, and 100% of

sampling dates, respectively. Ammonia, chlorophyll, total Kjeldahl nitrogen, and total organic carbon all showed decreasing trends, whereas nitrite+nitrate showed an increasing trend. Copper exceeded screening levels on 67% of sampling dates. 100% of the nickel samples were censored (i.e., below the LOD), the majority of which had an LOD above the screening criteria, making it impossible to draw conclusions about the current state of nickel in this location.

Recommendations for Corpus Christi Inner Harbor:
Continue monitoring and evaluation of new data is recommended to determine if efforts are needed to address water quality concerns. It is also recommended that additional characterization of metal levels and sources be considered. Because there are few calcifying organisms of interest (i.e., oysters) in the Corpus Christi Inner Harbor, process-based studies on the decreasing trend in alkalinity and pH should not be discounted but would be a low priority.

Redfish Bay:
Redfish Bay station 13426 displayed several indicators of water quality degradation. Enterococci levels were very high on average and exceeded the screening criteria on 58% of sampling dates, displaying an increasing trend over time. Nitrate levels were also very high and exceeded the screening level on 55% of sampling dates but displayed a stable trend. In addition, surface DO and transparency displayed decreasing trends, while total Kjeldahl nitrogen displayed an increasing trend. In contrast, ammonia and total organic carbon displayed a decreasing trend. Taken as a whole, these indicators suggest that Redfish Bay is experiencing water quality degradation.

Recommendations for Redfish Bay:
Steps should be taken to characterize pollutant sources to Redfish Bay and then to implement best management practices aimed at reducing pollutant loadings. In terms of potential pollutant sources, Redfish Bay receives stormwater runoff from residential areas of Aransas Pass as well as wastewater effluent from the Aransas Pass wastewater treatment plant. The influence of septic tanks from rural areas around the bay should also be evaluated, although a recent bacterial pollution study in a neighboring residential canal system suggests minimal contribution of septic waste to Redfish Bay (Powers et al., 2025). Future bacterial pollution studies focused on other neighboring areas could provide additional insight.

Oso Bay:
Oso Bay station 13440 displayed high and increasing chlorophyll and enterococci levels, which exceeded screening levels on 60% and 64% of sampling dates, respectively. In addition, nitrate exceeded screening levels on 50% of sampling dates, and transparency showed a decreasing trend. Total phosphorus and total organic carbon showed a decreasing trend. Station 13442 displayed high chlorophyll and enterococci that exceeded screening levels in 57% and 79% of sampling dates, respectively, but which had stable levels. Nitrate exceeded screening levels in 62% of sampling dates and surface DO displayed a decreasing trend. Ammonia, total phosphorus, and total organic carbon showed a decreasing trend.

Recommendations for Oso Bay:
A TMDL and I-Plan are in place for Oso Bay and Oso Creek (https://www.tceq.texas.gov/waterquality/tmdl/67-osobaybacteria.html). Steps should be taken to support stakeholder efforts to implement management actions listed in the plan.

Oso Creek:
Oso Creek station 13028 had multiple indicators suggesting water quality degradation. Chlorophyll, enterococci, nitrate, and total phosphorus values exceeded screening levels on 48%, 64%, 89%, and 92% of sampling dates, respectively. Nitrate levels were very high and showed an increasing trend, whereas ammonia showed a decreasing trend. Surface DO and pH showed a decreasing trend. Further upstream at station 13029, enterococci, nitrate, and total phosphorus exceeded screening levels on 89%, 63%, and 76% of sampling dates, respectively. DO showed a decreasing trend and enterococci showed an increasing trend. In contrast, ammonia, total phosphorus, total Kjeldahl nitrogen, and total organic carbon showed decreasing trends.

Recommendations for Oso Creek:
A TMDL and I-Plan are in place for Oso Bay and Oso Creek (https://www.tceq.texas.gov/waterquality/tmdl/67-osobaybacteria.html). Steps should be taken to support stakeholder efforts to implement management actions listed in the plan.

Nueces River:
Nueces River tidal station 12960 showed very high and increasing chlorophyll levels that exceeded the screening level in 84% of samples, while surface DO showed a decreasing trend. The dominant nitrogen form, total Kjeldahl nitrogen, had high concentrations on average that were stable. Salinity also showed an increasing trend over time. In contrast to these indicators of water quality degradation, several nutrient parameters (ammonia, nitrite+nitrate, total organic carbon) showed decreasing trends over time. On the upstream side of the saltwater dam in Calallen, no obvious water quality concerns were apparent at stations 20936 or 21815. Further upstream at station 12964, increasing ammonia, total phosphorus, total organic carbon, and alkalinity levels were noted. At the most upstream station (12965), chlorophyll levels exceeded the screening level on 24% of sampling dates and displayed an increasing trend.

Recommendations for Nueces River:
Steps should be taken to characterize pollutant sources to the Nueces River tidal segment and then to implement best management practices aimed at reducing pollutant loadings. In terms of potential pollutant sources, this segment receives stormwater runoff from adjacent residential areas, wastewater effluent from the Alison Wastewater Treatment Plant, runoff from upstream agricultural fields, and possibly discharge from nearby septic tanks.

Upper Laguna Madre system

The Upper Laguna Madre system included stations within the Upper Laguna Madre, Baffin Bay, Los Olmos Creek, San Fernando Creek, and Petronila Creek.

Upper Laguna Madre:
The only station in Upper Laguna Madre, 13445, displayed high and increasing chlorophyll, which exceeded the screening level on 27% of sampling dates. However, several of the nutrient parameters (ammonia, nitrite+nitrate, total Kjeldahl nitrogen) showed a decreasing trend.

Recommendations for Upper Laguna Madre:
Continue monitoring and evaluation of new data is recommended to determine if efforts are needed to address water quality concerns.

Baffin Bay:
In Baffin Bay, chlorophyll exceeded the screening level on 67% of sampling dates at station 13450 and exhibited an increasing trend. Both surface and bottom DO also showed a decreasing trend over time. In contrast to these symptoms of water quality degradation, total Kjeldahl nitrogen and nitrite+nitrate showed a decreasing trend, while transparency showed an increasing trend. At station 13452, chlorophyll exceeded the screening level on 100% of sampling dates and showed an increasing trend. Ammonia, nitrite+nitrate, total Kjeldahl nitrogen, and total organic carbon showed decreasing trends.

Recommendations for Baffin Bay:
A Watershed Protection Plan was implemented in 2023 to address watershed sources of pollutants to Baffin Bay (https://baffin.twri.tamu.edu/). Steps should be taken to support stakeholder efforts to implement management actions listed in the plan.

Petronila Creek:
For Petronila Creek, a general pattern of apparent water quality degradation was observed across multiple sites. For example, chlorophyll levels were often very high and exceeded the screening level on more than 20% of sampling dates at 12 of 14 stations, displaying an increasing trend at four of four stations with sufficient long-term data. Enterococci data were not available in Petronila Creek during the timeframe of this study, as the last enterococci samples were recorded in 2011. Surface DO showed a decreasing trend at five of 13 stations with sufficient long-term data. Nitrate levels were often very high and exceeded the screening level on more than 20% of sampling dates at 12 of 14 stations, displaying an increasing trend at one of two stations with sufficient long-term data. Very few indicators of improving water quality were observed.

Recommendations for Petronila Creek: The Petronila & San Fernando Creeks Watershed Protection Plan was implemented in 2023 to address watershed sources of pollutants to Petronila Creek (*see* https://baffin.twri.tamu.edu/). Steps should be taken to support stakeholder efforts to implement management actions listed in the plan. Future studies focusing on *E. coli* levels in addition to enterococci levels in the stream will provide information regarding bacterial pollution and trends.

San Fernando Creek:
As with Petronila Creek, a general pattern of apparent water quality degradation was observed across multiple stations in San Fernando Creek. At station 13033, chlorophyll was very high and exceeded the screening level on 39% of sampling dates but was stable over time. Enterococci were excessively high at station 13033, exceeding the screening level on 100% of sampling dates, and showed an increasing trend. Nitrate exceeded the screening level on more than 20% of sampling dates at two of six stations but was stable over time at the only station with sufficient long-term data (13033). Total phosphorus exceeded the screening level on more than 20% of sampling dates at five of six stations but was stable over time at station 13033. 100% of enterococci data exceeded the screening criteria and displayed an increasing trend in site 13033, although enterococci data

were not available for the other San Fernando Creek sites during this assessment. Very few indicators of improving water quality were observed.

Recommendations for San Fernando Creek:
The Petronila & San Fernando Creeks Watershed Protection Plan was implemented in 2023 to address watershed sources of pollutants to San Fernando Creek (https://baffin.twri.tamu.edu/). Steps should be taken to support stakeholder efforts to implement management actions listed in the plan. Future studies focusing on *E. coli* levels in addition to enterococci levels in the stream will provide information regarding bacterial pollution and trends.

Los Olmos Creek:
Los Olmos Creek had multiple indicators of water quality degradation. For example, chlorophyll levels were very high on average and exceeded the screening level on 79% of sampling dates. Enterococci data were not available for Los Olmos Creek during this assessment. Nitrate levels were excessively high, exceeding the screening level on 44% of sampling dates, and displaying an increasing trend. Total phosphorus also showed an increasing trend. Although there is no screening level for total Kjeldahl nitrogen, observed levels were very high and amongst the highest observed across the Coastal Bend. Only total organic carbon showed a decreasing trend.

Recommendations for Los Olmos Creek:
Steps should be taken to characterize pollutant sources to Los Olmos Creek and then to implement best management practices aimed at reducing pollutant loadings. The most expedient management measure would be to add Los Olmos Creek to the existing Petronila & San Fernando Creeks Watershed Protection Plan. Additional studies focusing on future measurements of enterococci in the stream will provide information regarding bacterial pollution and trends.

Limitations

Results presented here should be interpreted in the context of the study's limitations. For example, for some water quality parameters that change very rapidly, such as water temperature, quarterly sampling may be insufficient to detect trends. Additionally, previous studies have shown an increase in summertime water temperatures that are masked by nonsignificant annual trends (Bugica et al. 2020). Future studies focus on seasonal trends with increased sampling frequency could offer more insight into the changes in temperature occurring in the Coastal Bend.

Another limitation of this study pertains to the long-term trends calculated for nitrate and ammonia samples. Around the year 2000, there was an apparent laboratory methods change, which resulted in a higher LOD for these parameters. The higher LOD has caused more samples in recent years to be left-censored. Due to the nature of the censored Kendall's tau test, these values could be treated as higher than some of the historical values, despite being censored. We therefore recommend caution in interpreting the long-term nitrogen trend results. Since the nitrogen exceedances were calculated with data from the most recent seven years (well after the laboratory methods change), the exceedance results provide a more accurate representation of the nitrogen levels.

Due to limited data availability, uncertainty also remains regarding long-term trends in metal concentrations detected throughout the Coastal Bend. Only five sites had metal data recorded (i.e., Corpus Christi Bay, Corpus Christi Inner Harbor, Nueces Bay, Copano Bay, Chiltipin Creek), two of which were only sampled starting in 2021 (i.e., Copano Bay, Chiltipin Creek). Due to the lack of data, long-term trends could not be calculated for metal concentrations in the majority of waterbodies. The available metal data has additional limitations associated with it. For example, the LOD for nickel was often above the screening criteria (*see* Corpus Christi Bay, Nueces Bay, and Corpus Christi Inner Harbor above), therefore preventing us from determining an accurate percentage of samples that exceeded the criteria.

It is also important to point out that the current analysis does not present results from more targeted water quality sampling programs, such as the Texas Beach Watch program. For example, there is a known issue of bacterial contamination on the south shoreline of Corpus Christi Bay (Powers et al., 2020) that is better documented through high frequency sampling that occurs via Beach Watch, as opposed to the low spatial-temporal resolution sampling of SWQM. This issue is being addressed through a TMDL I-Plan approach as noted above. Another example is Little Bay in Rockport, which does not have a SWQM station but has been the subject of several targeted bacterial studies (Powers et al., 2021; Gitter et al., 2024) that are now guiding management actions.

CONCLUSIONS

In this study, localized water quality concerns within bay up to bay system scale were documented, but examples of relatively good water quality conditions were also common. In waterbodies where water quality concerns were noted, multiple water quality indicators often presented conflicting trends, which would suggest that while management intervention is not an immediate need in our professional opinion, ongoing monitoring data should be closely scrutinized to make a future determination about intervention needs. There were some notable examples, however, where water quality degradation is apparent and management interventions are warranted in our opinion. We recommend that these waterbodies should be prioritized in future funding opportunities for measures such as pollutant source tracking, pollutant load reduction strategies, and similarly related efforts.

REFERENCES

Bugica K, Sterba-Boatwright B, Wetz MS. 2020. Water quality trends in Texas estuaries. *Marine Pollution Bulletin* 152:110903. DOI: 10.1016/j.marpolbul.2020.110903.

ESRI. 2024. ArcGIS Pro.

Gitter A, Powers N, Postma S, Gregory L. 2024. *Evaluating Human Health Risks in Little Bay Final Report*.

Harwood VJ, Levine AD, Scott TM, Chivukula V, Lukasik J, Farrah SR, Rose JB. 2005. Validity of the Indicator Organism Paradigm for Pathogen Reduction in Reclaimed Water and Public Health Protection. *Applied and Environmental Microbiology* 71:3163–3170. DOI: 10.1128/AEM.71.6.3163-3170.2005.

Lee L. 2020. NADA: Nondetects and data analysis for environmental data.

Powers NC, Gitter A, Bleth N, Johnson A, Nicolay J, Ayers R, Turner JW. 2025. Microbial source tracking in a coastal residential canal system. *Science of The Total Environment* 983:179676. DOI: 10.1016/j.scitotenv.2025.179676.

Powers NC, Pinnell LJ, Wallgren HR, Marbach S, Turner JW. 2021. Water Quality Dynamics in Response to Rainfall along an Estuarine Ecocline. *ACS ES&T Water* 1:1503–1514. DOI: 10.1021/acsestwater.1c00051.

Powers NC, Wallgren HR, Marbach S, Turner JW. 2020. Relationship between Rainfall, Fecal Pollution, Antimicrobial Resistance, and Microbial Diversity in an Urbanized Subtropical Bay. *Applied and Environmental Microbiology* 86:e01229-20. DOI: 10.1128/AEM.01229-20.

R Core Team. 2021. R: A language and environment for statistical computing.

RStudio Team. 2023. RStudio: Integrated Development for R.

Schramm M, Kikoyo D, Wright J, Jain S. 2024. A meta-analysis of the impacts of best management practices on nonpoint source pollutant concentration. *Frontiers in Water* 6:1397615. DOI: 10.3389/frwa.2024.1397615.

TCEQ. 2024a. *2024 Texas Integrated Report - Texas 303(d) List (Category 5)*.

TCEQ. 2024b. *2024 Guidance for Assessing and Reporting Surface Water Quality in Texas*. Surface Water Quality Monitoring Program, Texas Commission on Environmental Quality.

USEPA. 2012. Recreational Water Quality Criteria.

West A, Wetz M. 2021. *Water Quality Status and Trends in Bays of the Texas Coastal Bend*. Coastal Bend Bays & Estuaries Program.

APPENDICES

Appendix A. Assessment units (AUs) and stations included in the analysis.

Table A1. Station and segments for each location in the analysis for the San Antonio Bay system.

Bay System	Segment ID	Station ID	Station Description
San Antonio Bay	2463	13400	MESQUITE BAY S OF ICWW CM 13

Table A2. Station and segments for each location in the analysis for the Aransas Bay system.

Bay System	Segment ID	Station ID	Station Description
Aransas Bay	2001	12943	MISSION RIVER AT FM 2678
	2002	12944	MISSION RIVER AT US 77
	2003	12947	ARANSAS RIVER TIDAL AT FM 629
		12948	ARANSAS RIVER TIDAL AT US 77
	2003A	12930	CHILTIPIN CREEK NE OF SINTON
	2004	12952	ARANSAS RIVER NEAR SKIDMORE
	2471	13402	ARANSAS BAY AT GIWW
	2472	13405	PORT BAY AT SH 188
		14783	COPANO BAY E BAYSIDE
		17724	COPANO BAY SW OUTER LAP BANK
	2473	17692	ST CHARLES BAY NE OF HAIL PT

Table A3. Station and segments for each location in the analysis for the Corpus Christi Bay system.

Bay System	Segment ID	Station ID	Station Description
Corpus Christi Bay	2101	12960	NUECES RIVER N OF VIOLA BASIN
	2102	12964	NUECES RIVER AT FM 666 BRIDGE
		12965	NUECES RIVER AT SH 359
		20936	NUECES RIVER AT HAZEL BAZEMORE PARK BOAT RAMP
		21815	NUECES RIVER IMMEDIATELY UPSTREAM OF THE SALTWATER BARRIER DAM AT LABONTE PARK
	2481	13409	CORPUS CHRISTI BAY AT CM 16
		13411	CORPUS CHRISTI BAY NE DODDRIDGE
		14355	CORPUS CHRISTI BAY SHAMROCK PT
	2482	13422	NUECES BAY NEAR SOUTH SHORE
	2483	13426	REDFISH BAY AT SH 361
	2484	13432	CC INNER HARBOR NR NAV BRIDGE
		13439	CC INNER HARBOR IN VIOLA BASIN
	2485	13440	OSO BAY AT PADRE ISLAND DR
		13442	OSO BAY AT OCEAN DR
	2485A	13028	OSO CREEK AT SH 286
		13029	OSO CREEK AT FM 763

Table A4. Station and segments for each location in the analysis for the Upper Laguna Madre system.

Bay System	Segment ID	Station ID	Station Description
Upper Laguna Madre	2203	13090	PETRONILA CK ABOVE TUNAS CONFL
	2204	13093	PETRONILA CREEK AT FM 70
		13094	PETRONILA CREEK AT FM 892
		13095	PETRONILA CREEK AT BEATTY RD
		13096	PETRONILA CREEK AT FM 665
		13099	PETRONILA CREEK AT FM 2826
		18484	UNNAMED DITCH OFF PETRONILA CR
		18642	TRIB OF PETRONILA CREEK FM 892
		20806	PETRONILA CREEK 181 METERS WEST AND 6 METERS SOUTH FROM THE INTERSECTION OF ALICE ROAD AND LOST CREEK ROAD
		21594	UNNAMED DRAINAGE DITCH TRIBUTARY TO PETRONILA CREEK AT NUECES COUNTY ROAD 28
		21596	UNNAMED TRIBUTARY TO PETRONILA CREEK AT FM 892
		21598	CITY OF CORPUS CHRISTI DRAINAGE DITCH OUTFALL TO PETRONILA CREEK FROM CEFE VALENZUELA LANDFILL
		21929	CITY OF CORPUS CHRISTI DRAINAGE DITCH OUTFALL TO PETRONILA CREEK FROM CEFE VALENZUELA LANDFILL AT FM 70
		21931	UNNAMED TRIBUTARY OF PETRONILA CREEK AT FM 3354 APPROX 200 METERS EAST OF NUECES CR 73
	2204B	13030	UNNAMED TRIBUTARY TO PETRONILA CREEK AT FM 70
	2491	13445	LAGUNA MADRE ICWW/BIRD ISLAND
	2492	13450	BAFFIN BAY AT CM 14
		13452	BAFFIN BAY AT CM 36
	2492A	13033	SAN FERNANDO CREEK AT US 77
		15969	SAN FERNANDO CK AT FM2045
		15971	SANTA GERTRUDIS CK AT CR1070
		15972	SANTA GERTRUDIS CK AT FM1717
		15975	SAN FERNANDO CREEK AT FM1930
		22327	SAN FERNANDO CREEK FM 1355
	2492B	13034	LOS OLMOS CREEK AT US 77

Appendix B. Parameter codes and screening criteria.

Table B1. Parameter codes, names, units, stressor that parameter is indicative of (OA= ocean acidification; M = metal contamination; N = nutrient pollution; FWI = freshwater inflow; CC = climate change), and screening levels (for nutrients) or criteria (for metals), if available.

Parameter code	Parameter name	Units	Stressor	Freshwater		Saltwater	
				Screening level	Criteria*	Screening level	Criteria*
00410	Alkalinity	mg/L as CaO3	OA	NA	NA	NA	NA
01106	Aluminum	µg/L	M	NA	NA (991)	NA	NA
00610	Ammonia	mg/L	N	0.46	NA	0.10	NA
01000	Arsenic	µg/L	M	NA	150 (340)	NA	78 (149)
01025	Cadmium	µg/L	M	NA	NA	NA	8.75 (40)
32211, 70953	Chlorophyll a	µg/L	N	21	NA	11.6	NA
01030	Chromium	µg/L	M	NA	NA	NA	49.6 (1090)
01040	Copper	µg/L	M	NA	NA	NA	3.6 (13.5)
00300	Dissolved oxygen	µg/L	N	NA	NA	NA	NA
31649, 31701	Enterococci	MPN/ 100mL	N	NA	35 (130)**	NA	35 (130)**
00951	Fluoride	mg/L	M	NA	NA	NA	NA
01049	Lead	µg/L	M	NA	NA	NA	5.3 (133)
71960	Mercury	µg/L	M	NA	1.3 (2.4)	NA	1.1 (2.1)
01065	Nickel	µg/L	M	0.997 (0.998)	NA	13.1 (118)	NA
00620	Nitrate	mg/L	N	1.1	NA	0.17	NA
00615	Nitrite	mg/L	N	NA	NA	NA	NA
00630	Nitrite+nitrate	mg/L	N	1.1***	NA	0.17***	NA
00400	pH	standard units	OA	NA	NA	NA	NA
00480	Salinity	PPT	FWI, CC	NA	NA	NA	NA
01147	Selenium	µg/L	M	NA	5 (20)	NA	136 (564)
01075	Silver	µg/L	M	NA	NA	NA	NA
00625	Total Kjeldahl nitrogen	mg/L	N	NA	NA	NA	NA
00680	Total organic carbon	mg/L	N	NA	NA	NA	NA
00665	Total phosphorus	mg/L	N	0.66	NA	0.21	NA
00078	Transparency	meters	N	NA	NA	NA	NA
00010	Water temperature	°C	CC	NA	NA	NA	NA
01090	Zinc	µg/L	M	NA	NA	84.2 (92.7)	NA

*Chronic criteria (acute criteria if available).
**Enterococci criteria are based on primary contact recreation and represent a geometric mean of 35 MPN and a statistical threshold value of 130 MPN that should not be exceeded in more than 10% of samples, based on 2012 EPA guidelines (USEPA, 2012). Additionally, TCEQ recognizes the EPA-approved alternative beach action value of 104 MPN for recreational use in coastal beaches.
***The screening level for nitrate is included for nitrite+nitrate in this table.

Appendix C. Tables showing water quality summary statistics.

Table C1. Water quality results in Mesquite Bay (San Antonio Bay system). Parameters with exceedances in over 20% of samples from the previous seven years are highlighted in red. Significant trends are bolded.

Waterbody name	Segment ID	Station ID	Parameter name	First year sampled	Arithmetic mean (3 years)	Geometric mean (3 years)	Percent exceedance (7 years)	Trend (10+ years)	Total sample size
Mesquite Bay	2463	13400	Alkalinity	1976	131.42	131.18	NA	**Decreasing**	152
			Ammonia	1973	0.02	0.02	6.67	**Decreasing**	163
			Chlorophyll a	1973	8.13	6.72	33.33	No trend	158
			Dissolved oxygen (surface)	1973	7.32	7.14	NA	**Decreasing**	161
			Enterococci	2001	6.25	5.95	0	No trend	58
			Fluoride	2001	0.48	0.46	NA	No trend	64
			Nitrite+nitrate	1976	0.02	0.02	7.14	**Decreasing**	102
			pH	1973	8.21	8.21	NA	No trend	162
			Salinity	1989	28.7	26.79	NA	No trend	102
			Temperature	1973	24.54	23.58	NA	No trend	164
			Total Kjeldahl nitrogen	1993	0.38	0.37	NA	**Decreasing**	88
			Total organic carbon	1974	3.38	2.45	NA	**Decreasing**	153
			Total phosphorus	1973	0.06	0.05	0	**Decreasing**	161
			Transparency	1989	0.66	0.59	NA	**Increasing**	101

Table C2. Water quality results in the Mission River (Aransas Bay system). Parameters with exceedances in over 20% of samples from the previous seven years are highlighted in red. Significant trends are bolded.

Waterbody name	Segment ID	Station ID	Parameter name	First year sampled	Arithmetic mean (3 years)	Geometric mean (3 years)	Percent exceedance (7 years)	Trend (10+ years)	Total sample size
Mission River	2001	12943	Alkalinity	1969	199.2	184.27	NA	No trend	159
			Ammonia	1969	0.07	0.06	0	**Decreasing**	190
			Chlorophyll a	1972	11.09	8.79	34.62	No trend	172
			Dissolved oxygen (bottom)	1970	6.24	5.87	NA	No trend	63
			Dissolved oxygen (surface)	1969	7.63	7.5	NA	**Decreasing**	194
			Enterococci	1999	559.28	132.84	35.71	No trend	97
			Nitrate	1969	1.61	0.13	10	No trend	108
			Nitrite	1969	0.04	0.01	NA	No trend	65
			pH	1969	8.18	8.18	NA	No trend	183
			Salinity	1988	14.76	8.58	NA	**Increasing**	121
			Temperature	1969	24.21	23.51	NA	No trend	194
			Total Kjeldahl nitrogen	1977	0.99	0.8	NA	No trend	70
			Total organic carbon	1974	2.73	1.71	NA	**Decreasing**	168
			Total phosphorus	1969	0.42	0.12	7.69	No trend	189
			Transparency	1989	0.29	0.28	NA	No trend	125
	2002	12944	Alkalinity	1969	295.5	286.92	NA	**Increasing**	165
			Ammonia	1969	0.06	0.06	0	**Decreasing**	200
			Chlorophyll a	1972	7.62	5.43	16	No trend	165
			Dissolved oxygen (surface)	1968	5.36	5.03	NA	**Decreasing**	207
			Nitrate	1969	0.49	0.11	10	**Decreasing**	111
			Nitrite	1969	0.01	0.01	NA	No trend	66
			pH	1969	7.61	7.61	NA	**Decreasing**	193

Table C2 (continued). Water quality results in the Mission River (Aransas Bay system). Parameters with exceedances in over 20% of samples from the previous seven years are highlighted in red. Significant trends are bolded.

Waterbody name	Segment ID	Station ID	Parameter name	First year sampled	Arithmetic mean (3 years)	Geometric mean (3 years)	Percent exceedance (7 years)	Trend (10+ years)	Total sample size
Mission River	2002	12944	Temperature	1968	22.14	21.59	NA	No trend	206
			Total Kjeldahl nitrogen	1981	0.71	0.67	NA	No trend	88
			Total organic carbon	1974	4.81	4.36	NA	**Decreasing**	164
			Total phosphorus	1969	0.15	0.09	3.85	No trend	201
			Transparency	1989	0.52	0.46	NA	**Increasing**	122

Table C3. Water quality results in Aransas River (Aransas Bay system). Parameters with exceedances in over 20% of samples from the previous seven years are highlighted in red. Significant trends are bolded.

Waterbody name	Segment ID	Station ID	Parameter name	First year sampled	Arithmetic mean (3 years)	Geometric mean (3 years)	Percent exceedance (7 years)	Trend (10+ years)	Total sample size
Aransas River	2003	12947	Alkalinity	2004	229.9	215.42	NA	No trend	75
			Ammonia	2004	0.06	0.06	0	No trend	74
			Chlorophyll a	2004	21.77	15.41	53.85	No trend	75
			Dissolved oxygen (surface)	2004	7.84	7.57	NA	No trend	77
			Enterococci	2004	981.37	185.14	33.33	No trend	76
			Nitrate	2018	0.63	0.12	10	NA	20
			Nitrite	2019	0.12	0.02	NA	NA	16
			pH	2004	8.32	8.32	NA	No trend	77
			Salinity	2004	6.61	3.48	NA	No trend	74
			Temperature	2004	24.32	23.64	NA	No trend	77
			Total Kjeldahl nitrogen	2011	1	0.97	NA	**Decreasing**	47
			Total organic carbon	2004	3.35	2.57	NA	**Decreasing**	74
			Total phosphorus	2004	0.37	0.35	11.54	No trend	75
			Transparency	2004	0.23	0.21	NA	**Decreasing**	77
		12948	Dissolved oxygen (surface)	1968	7.03	6.92	NA	No trend	138
			Enterococci	1999	18.47	12.27	7.69	**Decreasing**	31
			pH	1969	7.97	7.96	NA	No trend	124
			Temperature	1968	26.09	25.58	NA	No trend	140
			Transparency	1989	0.24	0.23	NA	No trend	58
	2004	12952	Alkalinity	1996	233.44	221.04	NA	No trend	87
			Ammonia	1996	0.07	0.06	0	No trend	86
			Chlorophyll a	1996	2.66	2.3	11.54	No trend	86

Table C3 (continued). Water quality results in Aransas River (Aransas Bay system). Parameters with exceedances in over 20% of samples from the previous seven years are highlighted in red. Significant trends are bolded.

Waterbody name	Segment ID	Station ID	Parameter name	First year sampled	Arithmetic mean (3 years)	Geometric mean (3 years)	Percent exceedance (7 years)	Trend (10+ years)	Total sample size
Aransas River	2004	12952	Dissolved oxygen (surface)	1997	5.59	5.3	NA	**Decreasing**	86
			Nitrate	2018	3.34	1.56	70.00	NA	20
			Nitrite	2019	0.07	0.01	NA	NA	16
			pH	1997	7.61	7.61	NA	**Decreasing**	86
			Temperature	1997	20.81	20.08	NA	No trend	87
			Total Kjeldahl nitrogen	1996	1.03	0.99	NA	No trend	51
			Total organic carbon	1996	6.03	5.95	NA	No trend	87
			Total phosphorus	1996	2.44	2.35	96.15	**Increasing**	87
			Transparency	1997	0.84	0.79	NA	**Increasing**	85

Table C4. Water quality results in Chiltipin Creek (Aransas Bay system). Parameters with exceedances in over 20% of samples from the previous seven years are highlighted in red. Significant trends are bolded.

Waterbody name	Segment ID	Station ID	Parameter name	First year sampled	Arithmetic mean (3 years)	Geometric mean (3 years)	Percent exceedance (7 years)	Trend (10+ years)	Total sample size
Chiltipin Creek	2003A	12930	Alkalinity	1969	248.7	243.1	NA	**Increasing**	25
			Aluminum	2021	109.25	48.77	0	NA	4
			Ammonia	1969	0.08	0.06	0	**Decreasing**	52
			Arsenic	2021	11.59	11.41	0	NA	4
			Cadmium	2021	0.04	0.04	NA	NA	4
			Chlorophyll a	1972	25.73	13.46	50	No trend	41
			Chromium	2021	2.92	2.08	NA	NA	4
			Dissolved oxygen (bottom)	1970	4.82	3.92	NA	No trend	7
			Dissolved oxygen (surface)	1968	7.06	6.94	NA	**Increasing**	55
			Nickel	2021	2.46	2.46	100	NA	4
			Nitrate	1969	1.07	0.28	10	No trend	51
			Nitrite	1969	0.05	0.02	NA	**Decreasing**	26
			pH	1969	8.18	8.17	NA	No trend	42
			Salinity	2021	3.06	2.31	NA	NA	9
			Selenium	2021	6.4	4.76	75	NA	4
			Silver	2021	0.25	0.25	NA	NA	4
			Temperature	1968	24.11	23.58	NA	No trend	55
			Total Kjeldahl nitrogen	1969	1.36	0.95	NA	No trend	11
			Total organic carbon	1974	2.98	2.76	NA	**Decreasing**	29
			Total phosphorus	1969	0.45	0.42	11.11	**Increasing**	50
			Transparency	2021	0.25	0.24	NA	NA	10

Table C5. Water quality results in Aransas Bay (Aransas Bay system). Parameters with exceedances in over 20% of samples from the previous seven years are highlighted in red. Significant trends are bolded.

Waterbody name	Segment ID	Station ID	Parameter name	First year sampled	Arithmetic mean (3 years)	Geometric mean (3 years)	Percent exceedance (7 years)	Trend (10+ years)	Total sample size
Aransas Bay	2471	13402	Alkalinity	1970	129.83	129.46	NA	**Decreasing**	159
			Ammonia	1970	0.02	0.02	0	**Decreasing**	181
			Chlorophyll a	1972	11.43	8.14	13.33	No trend	172
			Dissolved oxygen (bottom)	1969	8.47	8.35	NA	No trend	147
			Dissolved oxygen (surface)	1970	7.64	7.52	NA	No trend	187
			Enterococci	2001	5	5	0	No trend	56
			Fluoride	2001	0.31	0.27	NA	**Decreasing**	67
			Nitrite+nitrate	1976	0.02	0.02	0	**Decreasing**	113
			pH	1969	8.2	8.2	NA	**Decreasing**	174
			Salinity	1985	28.7	27.66	NA	No trend	113
			Temperature	1970	22.39	21.63	NA	No trend	188
			Total Kjeldahl nitrogen	1993	0.36	0.31	NA	No trend	94
			Total organic carbon	1974	1.75	1.1	NA	No trend	152
			Total phosphorus	1970	0.06	0.06	6.25	No trend	176
			Transparency	1989	1.04	0.91	NA	No trend	109

Table C6. Water quality results in Copano Bay (Aransas Bay system). Parameters with exceedances in over 20% of samples from the previous seven years are highlighted in red. Significant trends are bolded.

Waterbody name	Segment ID	Station ID	Parameter name	First year sampled	Arithmetic mean (3 years)	Geometric mean (3 years)	Percent exceedance (7 years)	Trend (10+ years)	Total sample size
Copano Bay (Port Bay)	2472	13405	Alkalinity	1976	155.5	154.21	NA	No trend	158
			Aluminum	2021	25	25	NA	NA	2
			Arsenic	2021	12.25	12.25	0	NA	2
			Cadmium	2021	0.03	0	0	NA	2
			Chlorophyll a	1973	9.78	6.47	38.89	**Increasing**	158
			Chromium	2021	1.08	0.91	0	NA	2
			Copper	2021	5.26	5.26	100	NA	2
			Dissolved oxygen (bottom)	1977	7.47	7.46	NA	No trend	31
			Dissolved oxygen (surface)	1973	7.2	7.15	NA	**Decreasing**	173
			Enterococci	1999	1702.5	1408.52	44.44	No trend	86
			Nickel	2021	4.46	4.37	0	NA	2
			Nitrate	1973	4.2	1.9	50	**Decreasing**	88
			Nitrite	1976	0.22	0.06	NA	No trend	54
			pH	1973	8.12	8.12	NA	**Decreasing**	174
			Salinity	1985	28.93	28.4	NA	No trend	116
			Selenium	2021	38.2	38.16	0	NA	2
			Silver	2021	0.25	0.25	NA	NA	2
			Temperature	1973	23.68	23.04	NA	No trend	177
			Total Kjeldahl nitrogen	1977	0.25	0.18	NA	No trend	43
			Total organic carbon	1974	0.69	0.66	NA	**Decreasing**	165
			Total phosphorus	1973	1.39	0.16	5.88	No trend	169
			Transparency	1990	0.24	0.2	NA	**Decreasing**	113

Table C6 (continued). Water quality results in Copano Bay (Aransas Bay system). Parameters with exceedances in over 20% of samples from the previous seven years are highlighted in red. Significant trends are bolded.

Waterbody name	Segment ID	Station ID	Parameter name	First year sampled	Arithmetic mean (3 years)	Geometric mean (3 years)	Percent exceedance (7 years)	Trend (10+ years)	Total sample size
Copano Bay (Port Bay)	2472	13405	Zinc	2021	10.45	10.44	0	NA	2
Copano Bay	2472	14783	Alkalinity	1998	117.33	116.57	NA	No trend	75
			Ammonia	1998	0.02	0.02	6.67	No trend	75
			Chlorophyll a	1998	8.92	7.19	13.33	No trend	74
			Dissolved oxygen (bottom)	1987	7.74	7.5	NA	No trend	55
			Dissolved oxygen (surface)	1999	7.27	7.02	NA	No trend	75
			Enterococci	2001	8.12	7.82	0	No trend	56
			Fluoride	2001	0.33	0.31	NA	No trend	64
			Nitrite+nitrate	2005	0.02	0.02	0	No trend	52
			pH	1999	8.12	8.12	NA	**Increasing**	75
			Salinity	1999	19.91	16.5	NA	**Increasing**	75
			Temperature	1999	23.83	22.71	NA	No trend	75
			Total Kjeldahl nitrogen	1998	0.61	0.6	NA	**Decreasing**	75
			Total organic carbon	1998	5.14	4.46	NA	**Increasing**	73
			Total phosphorus	1998	0.07	0.07	0	**Decreasing**	73
			Transparency	1999	0.62	0.39	NA	No trend	72
		17724	Alkalinity	2005	118.7	117.92	NA	No trend	52
			Ammonia	2005	0.02	0.02	6.67	No trend	53
			Chlorophyll a	2005	6.04	5.16	20	No trend	52
			Dissolved oxygen (bottom)	2005	7.53	7.31	NA	No trend	46
			Dissolved oxygen (surface)	2005	7.52	7.33	NA	No trend	54

Table C6 (continued). Water quality results in Copano Bay (Aransas Bay system). Parameters with exceedances in over 20% of samples from the previous seven years are highlighted in red. Significant trends are bolded.

Waterbody name	Segment ID	Station ID	Parameter name	First year sampled	Arithmetic mean (3 years)	Geometric mean (3 years)	Percent exceedance (7 years)	Trend (10+ years)	Total sample size
Copano Bay	2472	17724	Enterococci	2005	5	5	0	**Decreasing**	46
			Fluoride	2005	0.36	0.32	NA	No trend	51
			Nitrite+nitrate	2005	0.02	0.02	6.67	No trend	53
			pH	2005	8.14	8.14	NA	No trend	54
			Salinity	2005	23.52	21.23	NA	No trend	54
			Temperature	2005	24.17	22.99	NA	No trend	54
			Total Kjeldahl nitrogen	2005	0.5	0.49	NA	**Decreasing**	53
			Total organic carbon	2005	4.71	3.92	NA	**Increasing**	48
			Total phosphorus	2005	0.05	0.05	0	**Decreasing**	52
			Transparency	2005	0.72	0.69	NA	No trend	53

Table C7. Water quality results in St. Charles Bay (Aransas Bay system). Parameters with exceedances in over 20% of samples from the previous seven years are highlighted in red. Significant trends are bolded.

Waterbody name	Segment ID	Station ID	Parameter name	First year sampled	Arithmetic mean (3 years)	Geometric mean (3 years)	Percent exceedance (7 years)	Trend (10+ years)	Total sample size
St. Charles Bay	2473	17692	Alkalinity	2010	124.83	124.02	NA	No trend	34
			Ammonia	2010	0.04	0.03	6.67	No trend	33
			Chlorophyll a	2010	4.78	4.15	20	No trend	33
			Dissolved oxygen (surface)	2010	7.03	6.75	NA	No trend	35
			Enterococci	2010	5	5	0	No trend	29
			Fluoride	2010	0.48	0.44	NA	No trend	32
			Nitrite+nitrate	2010	0.03	0.03	0	No trend	35
			pH	2010	8.11	8.11	NA	**Increasing**	35
			Salinity	2010	25.88	23.85	NA	No trend	35
			Temperature	2010	24.61	23.7	NA	No trend	35
			Total Kjeldahl nitrogen	2010	0.46	0.45	NA	**Decreasing**	33
			Total organic carbon	2010	4.12	2.94	NA	No trend	32
			Total phosphorus	2010	0.06	0.05	0	No trend	33
			Transparency	2010	0.58	0.57	NA	No trend	35

Table C8. Water quality results in Nueces River (Corpus Christi Bay system). Parameters with exceedances in over 20% of samples from the previous seven years are highlighted in red. Significant trends are bolded.

Waterbody name	Segment ID	Station ID	Parameter name	First year sampled	Arithmetic mean (3 years)	Geometric mean (3 years)	Percent exceedance (7 years)	Trend (10+ years)	Total sample size
Nueces River	2101	12960	Alkalinity	1976	171.12	169.43	NA	No trend	166
			Ammonia	1973	0.26	0.09	5.56	**Decreasing**	177
			Chlorophyll a	1973	152.7	106.94	84.21	**Increasing**	175
			Dissolved oxygen (surface)	1973	8.6	8.4	NA	**Decreasing**	175
			Enterococci	2001	164.2	34.16	5.88	No trend	64
			Fluoride	2001	0.25	0.21	NA	No trend	79
			Nitrite+nitrate	1976	0.12	0.06	0	**Decreasing**	138
			pH	1973	8.7	8.7	NA	**Increasing**	175
			Salinity	1979	13.41	9.11	NA	**Increasing**	143
			Temperature	1973	23.45	22.89	NA	No trend	176
			Total Kjeldahl nitrogen	1979	2.01	1.55	NA	No trend	133
			Total organic carbon	1974	10.57	10.04	NA	**Decreasing**	169
			Total phosphorus	1973	0.47	0.38	15.79	No trend	171
			Transparency	1989	0.26	0.23	NA	No trend	111
	2102	12964	Alkalinity	1978	200.8	199.14	NA	**Increasing**	161
			Ammonia	1998	0.05	0.05	0	**Increasing**	100
			Chlorophyll a	1998	3.92	2.98	4	No trend	96
			Dissolved oxygen (surface)	1998	7.79	7.75	NA	No trend	100
			Nitrate	1998	0.26	0.11	0	No trend	32
			Nitrite	1998	0.09	0.03	NA	No trend	28
			pH	1998	8.11	8.11	NA	No trend	101
			Temperature	1998	23.03	22.67	NA	No trend	101

Table C8 (continued). Water quality results in Nueces River (Corpus Christi Bay system). Parameters with exceedances in over 20% of samples from the previous seven years are highlighted in red. Significant trends are bolded.

Waterbody name	Segment ID	Station ID	Parameter name	First year sampled	Arithmetic mean (3 years)	Geometric mean (3 years)	Percent exceedance (7 years)	Trend (10+ years)	Total sample size
Nueces River	2102	12964	Total Kjeldahl nitrogen	1998	0.81	0.61	NA	No trend	60
			Total organic carbon	1998	5.86	5.81	NA	**Increasing**	95
			Total phosphorus	1998	0.38	0.3	8	**Increasing**	100
			Transparency	2000	0.19	0.19	NA	No trend	92
		12965	Chlorophyll a	1998	14.17	6.6	24	**Increasing**	95
			Dissolved oxygen (surface)	1998	8.71	8.67	NA	No trend	99
			pH	1984	8.24	8.24	NA	No trend	102
			Temperature	1982	20.89	20.33	NA	No trend	131
			Transparency	1999	0.29	0.29	NA	No trend	93
		20936	Alkalinity	2011	201	199.26	NA	**Increasing**	47
			Ammonia	2011	0.05	0.05	0	No trend	46
			Chlorophyll a	2011	10.25	6.46	11.54	No trend	47
			Dissolved oxygen (surface)	2011	8.17	8.12	NA	No trend	47
			Nitrate	2018	0.33	0.12	5	NA	20
			Nitrite	2019	0.11	0.03	NA	NA	16
			pH	2011	8.05	8.05	NA	No trend	47
			Temperature	2011	23.33	22.85	NA	No trend	47
			Total Kjeldahl nitrogen	2015	0.8	0.63	NA	NA	26
			Total organic carbon	2011	5.57	5.52	NA	**Decreasing**	47
			Total phosphorus	2011	0.28	0.26	0	No trend	47
			Transparency	2011	0.37	0.34	NA	**Increasing**	47

Table C8 (continued). Water quality results in Nueces River (Corpus Christi Bay system). Parameters with exceedances in over 20% of samples from the previous seven years are highlighted in red. Significant trends are bolded.

Waterbody name	Segment ID	Station ID	Parameter name	First year sampled	Arithmetic mean (3 years)	Geometric mean (3 years)	Percent exceedance (7 years)	Trend (10+ years)	Total sample size
Nueces River	2102	21815	Chlorophyll a	2016	6.5	5.45	3.85	NA	26
			Dissolved oxygen (surface)	2016	8.76	8.68	NA	NA	26
			pH	2016	8.06	8.06	NA	NA	26
			Temperature	2016	23.83	23.39	NA	NA	26
			Transparency	2016	0.6	0.59	NA	NA	26

Table C9. Water quality results in Oso Creek (Corpus Christi Bay system). Parameters with exceedances in over 20% of samples from the previous seven years are highlighted in red. Significant trends are bolded.

Waterbody name	Segment ID	Station ID	Parameter name	First year sampled	Arithmetic mean (3 years)	Geometric mean (3 years)	Percent exceedance (7 years)	Trend (10+ years)	Total sample size
Oso Creek	2485A	13028	Alkalinity	1976	165.22	161.8	NA	No trend	137
			Ammonia	1972	0.33	0.23	12	**Decreasing**	163
			Chlorophyll a	1972	16.46	10.16	48	No trend	152
			Dissolved oxygen (surface)	1971	6.6	6.35	NA	**Decreasing**	165
			Enterococci	1999	678.67	271.86	64	No trend	91
			Nitrate	1972	8.59	4.83	89.47	**Increasing**	79
			Nitrite	1976	0.27	0.11	NA	No trend	50
			pH	1972	7.63	7.63	NA	**Decreasing**	164
			Salinity	1985	7.16	4.41	NA	No trend	113
			Temperature	1971	24.32	23.96	NA	No trend	167
			Total Kjeldahl nitrogen	1993	1.57	1.44	NA	No trend	66
			Total organic carbon	1974	3.68	3.55	NA	**Decreasing**	146
			Total phosphorus	1972	2.58	2.24	92	No trend	158
			Transparency	1989	0.22	0.2	NA	No trend	126
		13029	Alkalinity	1981	199.11	194.47	NA	**Increasing**	75
			Ammonia	1981	0.36	0.13	8	**Decreasing**	74
			Chlorophyll a	1989	13.38	4.39	16	No trend	49
			Dissolved oxygen (surface)	1981	4.57	4.43	NA	**Decreasing**	76
			Enterococci	2004	1584	1361.92	88.89	**Increasing**	24
			Nitrate	1981	2.57	1.02	63.16	No trend	40
			Nitrite	1981	0.27	0.09	NA	No trend	53
			pH	1981	7.57	7.56	NA	No trend	76

Table C9 (continued). Water quality results in Oso Creek (Corpus Christi Bay system). Parameters with exceedances in over 20% of samples from the previous seven years are highlighted in red. Significant trends are bolded.

Waterbody name	Segment ID	Station ID	Parameter name	First year sampled	Arithmetic mean (3 years)	Geometric mean (3 years)	Percent exceedance (7 years)	Trend (10+ years)	Total sample size
Oso Creek	2485A	13029	Salinity	1990	3.85	3.83	NA	No trend	24
			Temperature	1981	22.57	22.1	NA	No trend	80
			Total Kjeldahl nitrogen	1981	1.47	1.33	NA	**Decreasing**	60
			Total organic carbon	1981	4.32	4.23	NA	**Decreasing**	66
			Total phosphorus	1981	1.36	1.1	76	**Decreasing**	75
			Transparency	1989	0.22	0.18	NA	No trend	47

Table C10. Water quality results in Corpus Christi Bay (Corpus Christi Bay system). Parameters with exceedances in over 20% of samples from the previous seven years are highlighted in red. Significant trends are bolded.

Waterbody name	Segment ID	Station ID	Parameter name	First year sampled	Arithmetic mean (3 years)	Geometric mean (3 years)	Percent exceedance (7 years)	Trend (10+ years)	Total sample size
Corpus Christi Bay	2481	13409	Alkalinity	1976	125.5	125.46	NA	**Decreasing**	147
			Aluminum	1997	416.67	396.85	NA	No trend	26
			Ammonia	1973	0.03	0.02	11.76	No trend	156
			Arsenic	1997	25	13.46	14.29	No trend	24
			Cadmium	1997	1	0.54	0	No trend	25
			Chlorophyll a	1973	6.22	6.02	0	No trend	153
			Chromium	1997	16.67	15.87	0	No trend	26
			Copper	1997	5.5	3.16	75*	No trend	16
			Dissolved oxygen (bottom)	1973	7.29	7.19	NA	No trend	140
			Dissolved oxygen (surface)	1973	7.31	7.22	NA	No trend	159
			Enterococci	2002	10.88	7.73	0	No trend	57
			Fluoride	2002	0.48	0.47	NA	**Decreasing**	67
			Lead	1997	0.12	0.12	0	No trend	24
			Mercury	2006	0	0	0	No trend	25
			Nickel	1997	20.83	19.84	57.14**	No trend	24
			Nitrite+nitrate	1976	0.04	0.04	0	**Decreasing**	110
			pH	1973	8.21	8.21	NA	No trend	157
			Salinity	1985	32.29	32.18	NA	No trend	98
			Selenium	1974	5	2.69	0	No trend	27
			Silver	1997	4	2.15	NA	No trend	25
			Temperature	1973	23.68	22.64	NA	No trend	160
			Total Kjeldahl nitrogen	1993	0.34	0.34	NA	**Decreasing**	78

Table C10 (continued). Water quality results in Corpus Christi Bay (Corpus Christi Bay system). Parameters with exceedances in over 20% of samples from the previous seven years are highlighted in red. Significant trends are bolded.

Waterbody name	Segment ID	Station ID	Parameter name	First year sampled	Arithmetic mean (3 years)	Geometric mean (3 years)	Percent exceedance (7 years)	Trend (10+ years)	Total sample size
Corpus Christi Bay	2481	13409	Total organic carbon	1974	2	1.15	NA	**Decreasing**	144
			Total phosphorus	1973	0.04	0.04	0	No trend	153
			Transparency	1989	0.99	0.98	NA	No trend	99
			Zinc	1997	25.83	24.66	0	No trend	26
		13411	Alkalinity	1976	128.08	128.01	NA	**Decreasing**	156
			Ammonia	1973	0.03	0.03	11.76	**Decreasing**	164
			Chlorophyll a	1973	6.2	6.07	0	No trend	159
			Dissolved oxygen (bottom)	1973	6.48	6.33	NA	No trend	127
			Dissolved oxygen (surface)	1973	7.33	7.23	NA	No trend	165
			Enterococci	2001	5	5	6.67	**Decreasing**	62
			Fluoride	2001	0.42	0.38	NA	**Decreasing**	71
			Nitrite+nitrate	1976	0.03	0.03	0	**Decreasing**	105
			pH	1973	8.2	8.2	NA	No trend	166
			Salinity	1985	32.31	32.18	NA	No trend	113
			Temperature	1973	23.61	22.67	NA	No trend	168
			Total Kjeldahl nitrogen	1993	0.42	0.41	NA	**Decreasing**	94
			Total organic carbon	1974	3.12	2.26	NA	No trend	153
			Total phosphorus	1973	0.04	0.04	0	**Decreasing**	160
			Transparency	1989	0.84	0.82	NA	No trend	111

Table C10 (continued). Water quality results in Corpus Christi Bay (Corpus Christi Bay system). Parameters with exceedances in over 20% of samples from the previous seven years are highlighted in red. Significant trends are bolded.

Waterbody name	Segment ID	Station ID	Parameter name	First year sampled	Arithmetic mean (3 years)	Geometric mean (3 years)	Percent exceedance (7 years)	Trend (10+ years)	Total sample size
Corpus Christi Bay	2481	14355	Alkalinity	1998	126.92	126.87	NA	No trend	81
			Ammonia	1998	0.02	0.02	11.76	No trend	80
			Chlorophyll a	1998	6.13	5.46	0	No trend	80
			Dissolved oxygen (bottom)	1998	6.35	6.26	NA	No trend	55
			Dissolved oxygen (surface)	1999	7.33	7.21	NA	No trend	82
			Enterococci	2001	10	8.41	0	No trend	63
			Fluoride	2001	0.43	0.41	NA	**Decreasing**	70
			Nitrite+nitrate	2005	0.05	0.04	11.76	No trend	58
			pH	1999	8.21	8.21	NA	**Increasing**	82
			Salinity	1999	32.93	32.76	NA	No trend	81
			Temperature	1999	22.82	21.7	NA	No trend	82
			Total Kjeldahl nitrogen	1998	0.61	0.46	NA	**Decreasing**	76
			Total organic carbon	1998	2.64	1.85	NA	**Increasing**	75
			Total phosphorus	1998	0.03	0.03	0	No trend	77
			Transparency	1999	0.99	0.92	NA	No trend	80

*One copper sample in site 13409 was censored (i.e., below the LOD) with an LOD above the screening criteria.
**71% of nickel samples in site 13409 were censored (i.e., below the LOD). Of those samples, 80% had an LOD above the screening criteria.

Table C11. Water quality results in Nueces Bay (Corpus Christi Bay system). Parameters with exceedances in over 20% of samples from the previous seven years are highlighted in red. Significant trends are bolded.

Waterbody name	Segment ID	Station ID	Parameter name	First year sampled	Arithmetic mean (3 years)	Geometric mean (3 years)	Percent exceedance (7 years)	Trend (10+ years)	Total sample size
Nueces Bay	2482	13422	Alkalinity	1976	131.71	131.61	NA	No trend	156
			Aluminum	2003	507.67	507.55	NA	**Increasing**	26
			Ammonia	1973	0.03	0.02	11.76	**Decreasing**	167
			Arsenic	2003	8.33	7.88	0	No trend	27
			Cadmium	2003	0.25	0.25	0	No trend	26
			Chlorophyll a	1973	8.19	7.76	25	No trend	156
			Chromium	2003	16.67	15.87	0	No trend	27
			Copper	2003	1	1	50	No trend	21
			Dissolved oxygen (surface)	1973	7.2	7.16	NA	**Decreasing**	169
			Enterococci	2001	129	15.06	6.25	No trend	64
			Fluoride	2001	0.56	0.43	NA	No trend	74
			Lead	2003	0.17	0.16	0	No trend	27
			Mercury	2005	0.01	0.01	0	No trend	27
			Nickel	2003	20.83	19.84	66.67*	No trend	26
			Nitrite+nitrate	1976	0.11	0.05	5.56	**Decreasing**	109
			pH	1973	8.1	8.1	NA	No trend	168
			Salinity	1985	31.13	31.07	NA	**Increasing**	113
			Selenium	1974	4.17	2.5	0	No trend	29
			Silver	2003	1	1	NA	No trend	26
			Temperature	1973	21.66	21.19	NA	No trend	169
			Total Kjeldahl nitrogen	1993	0.42	0.42	NA	No trend	100

Table C11 (continued). Water quality results in Nueces Bay (Corpus Christi Bay system). Parameters with exceedances in over 20% of samples from the previous seven years are highlighted in red. Significant trends are bolded.

Waterbody name	Segment ID	Station ID	Parameter name	First year sampled	Arithmetic mean (3 years)	Geometric mean (3 years)	Percent exceedance (7 years)	Trend (10+ years)	Total sample size
Nueces Bay	2482	13422	Total organic carbon	1974	3.84	3.43	NA	No trend	153
			Total phosphorus	1973	0.07	0.07	5.56	No trend	159
			Transparency	1991	0.51	0.5	NA	No trend	110
			Zinc	2003	16.67	15.87	0	No trend	27

*78% of nickel samples in site 13422 were censored (i.e., below the LOD). Of those samples, 71% had an LOD above the screening criteria.

Table C12. Water quality results in Redfish Bay (Corpus Christi Bay system). Parameters with exceedances in over 20% of samples from the previous seven years are highlighted in red. Significant trends are bolded.

Waterbody name	Segment ID	Station ID	Parameter name	First year sampled	Arithmetic mean (3 years)	Geometric mean (3 years)	Percent exceedance (7 years)	Trend (10+ years)	Total sample size
Redfish Bay	2483	13426	Alkalinity	1976	142	141.2	NA	**Decreasing**	172
			Ammonia	1972	0.05	0.05	0	**Decreasing**	195
			Chlorophyll a	1972	5.44	4.12	7.69	No trend	187
			Dissolved oxygen (bottom)	1974	6.81	6.68	NA	No trend	118
			Dissolved oxygen (surface)	1971	6.97	6.9	NA	**Decreasing**	198
			Enterococci	1999	1071	618.27	57.69	**Increasing**	94
			Nitrate	1971	6.91	1.16	55	No trend	119
			Nitrite	1976	0.2	0.03	NA	No trend	62
			pH	1972	8.22	8.22	NA	No trend	196
			Salinity	1979	28.47	27.79	NA	No trend	161
			Temperature	1971	23.34	22.7	NA	No trend	199
			Total Kjeldahl nitrogen	1979	0.65	0.41	NA	**Increasing**	84
			Total organic carbon	1974	0.39	0.34	NA	**Decreasing**	182
			Total phosphorus	1971	0.11	0.06	12	No trend	194
			Transparency	1989	0.34	0.32	NA	**Decreasing**	128

Table C13. Water quality results in Corpus Christi Inner Harbor (Corpus Christi Bay system). Parameters with exceedances in over 20% of samples from the previous seven years are highlighted in red. Significant trends are bolded.

Waterbody name	Segment ID	Station ID	Parameter name	First year sampled	Arithmetic mean (3 years)	Geometric mean (3 years)	Percent exceedance (7 years)	Trend (10+ years)	Total sample size
Corpus Christi Inner Harbor	2484	13432	Alkalinity	1969	128.57	128.54	NA	**Decreasing**	168
			Ammonia	1969	0.06	0.04	50	**Decreasing**	193
			Chlorophyll a	1972	4.56	4.06	0	**Decreasing**	174
			Dissolved oxygen (surface)	1969	6.79	6.72	NA	No trend	195
			Enterococci	2001	8	6.6	5.88	No trend	60
			Fluoride	2001	0.51	0.46	NA	**Decreasing**	72
			Nitrite+nitrate	1969	0.33	0.23	83.33	No trend	121
			pH	1969	7.96	7.96	NA	**Decreasing**	186
			Salinity	1989	31.2	31.15	NA	No trend	116
			Temperature	1969	21.96	21.57	NA	No trend	197
			Total Kjeldahl nitrogen	1993	0.47	0.46	NA	**Decreasing**	96
			Total organic carbon	1974	3.56	3.21	NA	**Decreasing**	160
			Total phosphorus	1969	0.08	0.07	0	**Decreasing**	182
			Transparency	1989	1.16	1.12	NA	No trend	117
		13439	Alkalinity	1974	128.29	128.25	NA	**Decreasing**	167
			Aluminum	1997	500	500	NA	No trend	42
			Ammonia	1973	0.05	0.04	33.33	**Decreasing**	176
			Arsenic	1997	12.5	9.92	0	No trend	40
			Cadmium	1997	0.25	0.25	0	No trend	41
			Chlorophyll a	1973	10.68	7.3	25	**Decreasing**	168
			Chromium	1997	20	20	0	No trend	42
			Copper	1990	4.49	4.49	66.67	No trend	38

Table C13 (continued). Water quality results in Corpus Christi Inner Harbor (Corpus Christi Bay system). Parameters with exceedances in over 20% of samples from the previous seven years are highlighted in red. Significant trends are bolded.

Waterbody name	Segment ID	Station ID	Parameter name	First year sampled	Arithmetic mean (3 years)	Geometric mean (3 years)	Percent exceedance (7 years)	Trend (10+ years)	Total sample size
Corpus Christi Inner Harbor	2484	13439	Dissolved oxygen (bottom)	1973	6.59	6.53	NA	No trend	156
			Dissolved oxygen (surface)	1973	7.21	7.12	NA	No trend	177
			Enterococci	2001	79	13.58	5.88	No trend	60
			Fluoride	2001	0.39	0.36	NA	**Decreasing**	72
			Lead	1997	0.25	0.2	0	No trend	41
			Mercury	2005	0	0	0	No trend	26
			Nickel	1997	25	25	NA*	No trend	41
			Nitrite+nitrate	1974	0.58	0.55	100	**Increasing**	121
			pH	1973	7.99	7.98	NA	**Decreasing**	177
			Salinity	1989	30.29	30.24	NA	No trend	118
			Selenium	1974	5.08	3.68	0	No trend	38
			Silver	1997	1	1	NA	No trend	39
			Temperature	1973	22.7	22.37	NA	No trend	180
			Total Kjeldahl nitrogen	1993	0.45	0.45	NA	**Decreasing**	96
			Total organic carbon	1974	3.58	3.29	NA	**Decreasing**	159
			Total phosphorus	1973	0.09	0.08	0	No trend	167
			Transparency	1989	1.56	1.42	NA	No trend	118
			Zinc	1997	20	20	0	No trend	46

*100% of nickel samples in site 13439 were censored (i.e., below the LOD). Of those samples, 62.5% had an LOD above the screening criteria.

Table C14. Water quality results in Oso Bay (Corpus Christi Bay system). Parameters with exceedances in over 20% of samples from the previous seven years are highlighted in red. Significant trends are bolded.

Waterbody name	Segment ID	Station ID	Parameter name	First year sampled	Arithmetic mean (3 years)	Geometric mean (3 years)	Percent exceedance (7 years)	Trend (10+ years)	Total sample size
Oso Bay	2485	13440	Alkalinity	1981	160.44	159.6	NA	No trend	156
			Ammonia	1981	0.06	0.05	8	No trend	164
			Chlorophyll a	1981	10.31	7	60	**Increasing**	150
			Dissolved oxygen (surface)	1981	6.37	6.27	NA	No trend	161
			Enterococci	1999	1827.33	1286.74	64	**Increasing**	94
			Nitrate	1981	1.31	0.37	50	No trend	80
			Nitrite	1981	0.24	0.04	NA	No trend	53
			pH	1981	8.22	8.22	NA	No trend	163
			Salinity	1985	33.3	32.57	NA	No trend	129
			Temperature	1981	21.98	21.09	NA	No trend	164
			Total Kjeldahl nitrogen	1993	1.19	1	NA	No trend	71
			Total organic carbon	1981	0.59	0.5	NA	**Decreasing**	160
			Total phosphorus	1981	0.11	0.09	16.67	**Decreasing**	157
			Transparency	1989	0.15	0.12	NA	**Decreasing**	129
		13442	Alkalinity	1976	147.67	146.62	NA	No trend	67
			Ammonia	1973	0.07	0.06	7.14	**Decreasing**	79
			Chlorophyll a	1973	9.78	5.13	57.14	No trend	73
			Dissolved oxygen (surface)	1973	6.5	6.42	NA	**Decreasing**	79
			Enterococci	2019	1228.11	796.56	78.57	NA	14
			Nitrate	1973	1.66	0.61	61.54	No trend	74
			Nitrite	1976	0.22	0.03	NA	No trend	41

Table C14 (continued). Water quality results in Oso Bay (Corpus Christi Bay system). Parameters with exceedances in over 20% of samples from the previous seven years are highlighted in red. Significant trends are bolded.

Waterbody name	Segment ID	Station ID	Parameter name	First year sampled	Arithmetic mean (3 years)	Geometric mean (3 years)	Percent exceedance (7 years)	Trend (10+ years)	Total sample size
Oso Bay	2485	13442	pH	1973	8.2	8.2	NA	No trend	78
			Salinity	1985	33.17	32.8	NA	No trend	23
			Temperature	1973	22.69	22.01	NA	No trend	80
			Total Kjeldahl nitrogen	1995	0.58	0.39	NA	No trend	14
			Total organic carbon	1974	0.46	0.38	NA	**Decreasing**	71
			Total phosphorus	1973	0.08	0.07	7.69	**Decreasing**	75
			Transparency	1989	0.27	0.24	NA	No trend	23

Table C15. Water quality results in Petronila Creek (Upper Laguna Madre system). Parameters with exceedances in over 20% of samples from the previous seven years are highlighted in red. Significant trends are bolded.

Waterbody name	Segment ID	Station ID	Parameter name	First year sampled	Arithmetic mean (3 years)	Geometric mean (3 years)	Percent exceedance (7 years)	Trend (10+ years)	Total sample size
Petronila Creek	2203	13090	Alkalinity	1989	89.8	87.65	NA	**Decreasing**	84
			Ammonia	1989	0.03	0.03	0	No trend	81
			Chlorophyll a	1989	46.92	27.06	66.67	**Increasing**	80
			Dissolved oxygen (surface)	1989	8.67	7.96	NA	No trend	84
			Enterococci	2001	23.25	13.32	9.09	No trend	41
			Fluoride	2001	0.16	0.16	NA	No trend	54
			Nitrite+nitrate	1989	0.1	0.05	0	No trend	70
			pH	1989	8.53	8.52	NA	No trend	85
			Salinity	1989	10.68	5.4	NA	**Decreasing**	82
			Temperature	1989	24	23.21	NA	No trend	85
			Total Kjeldahl nitrogen	1993	0.75	0.69	NA	No trend	73
			Total organic carbon	1989	8.52	7.95	NA	**Increasing**	80
			Total phosphorus	1989	0.17	0.14	0	No trend	78
			Transparency	1989	0.22	0.19	NA	No trend	76
	2204	13093	Ammonia	1972	0.06	0.06	0	**Decreasing**	74
			Chlorophyll a	1972	35.37	27.37	83.33	**Increasing**	71
			Dissolved oxygen (bottom)	2010	6.35	5.78	NA	No trend	47
			Dissolved oxygen (surface)	1971	8.63	8.28	NA	No trend	83
			Nitrate	1972	1.95	0.78	25	No trend	41
			Nitrite	1976	0.26	0.05	NA	No trend	19
			pH	1972	8.04	8.04	NA	No trend	78
			Temperature	1971	24.56	24	NA	No trend	83

Table C15 (continued). Water quality results in Petronila Creek (Upper Laguna Madre system). Parameters with exceedances in over 20% of samples from the previous seven years are highlighted in red. Significant trends are bolded.

Waterbody name	Segment ID	Station ID	Parameter name	First year sampled	Arithmetic mean (3 years)	Geometric mean (3 years)	Percent exceedance (7 years)	Trend (10+ years)	Total sample size
Petronila Creek	2204	13093	Total Kjeldahl nitrogen	2014	1.08	1.03	NA	**Decreasing**	21
			Total phosphorus	1972	0.13	0.08	5.56	No trend	73
			Transparency	2010	0.24	0.23	NA	No trend	48
		13094	Alkalinity	1984	161.5	154.27	NA	**Increasing**	126
			Ammonia	1984	0.05	0.05	0	No trend	125
			Chlorophyll a	1985	46.59	32.92	77.78	**Increasing**	121
			Dissolved oxygen (surface)	1984	9.99	8.62	NA	**Decreasing**	131
			Nitrate	1984	2.33	1.28	33.33	**Increasing**	44
			Nitrite	1989	0.18	0.03	NA	No trend	34
			pH	1984	7.62	7.62	NA	**Decreasing**	130
			Temperature	1984	23.29	22.86	NA	No trend	131
			Total Kjeldahl nitrogen	1993	1.05	0.95	NA	**Increasing**	104
			Total organic carbon	1984	1.5	1.18	NA	**Decreasing**	122
			Total phosphorus	1984	0.1	0.07	3.7	No trend	123
			Transparency	1990	0.35	0.31	NA	No trend	117
		13095	Ammonia	2020	0.08	0.07	0	NA	11
			Chlorophyll a	2020	41.46	27.3	72.73	NA	11
			Dissolved oxygen (surface)	2014	9.97	9.56	NA	No trend	31
			Nitrate	2020	2.68	1.72	63.64	NA	11
			Nitrite	2020	0.21	0.05	NA	NA	11
			pH	2014	7.76	7.76	NA	No trend	31
			Temperature	2014	24.07	23.63	NA	No trend	31

Table C15 (continued). Water quality results in Petronila Creek (Upper Laguna Madre system). Parameters with exceedances in over 20% of samples from the previous seven years are highlighted in red. Significant trends are bolded.

Waterbody name	Segment ID	Station ID	Parameter name	First year sampled	Arithmetic mean (3 years)	Geometric mean (3 years)	Percent exceedance (7 years)	Trend (10+ years)	Total sample size
Petronila Creek	2204	13095	Total Kjeldahl nitrogen	2020	1.17	1.11	NA	NA	11
			Total phosphorus	2020	0.38	0.11	9.09	NA	11
			Transparency	2014	0.35	0.29	NA	**Increasing**	31
		13096	Alkalinity	1995	157.4	148.36	NA	**Increasing**	75
			Ammonia	1995	0.06	0.06	3.7	No trend	74
			Chlorophyll a	1995	30.27	19.02	59.26	**Decreasing**	71
			Dissolved oxygen (surface)	1996	8.94	8.4	NA	**Decreasing**	75
			Nitrate	2018	2.69	1.75	42.86	NA	21
			Nitrite	2019	0.31	0.12	NA	NA	17
			pH	1996	7.75	7.75	NA	No trend	75
			Temperature	1996	22.85	22.36	NA	No trend	75
			Total Kjeldahl nitrogen	1995	1.08	1.03	NA	No trend	66
			Total organic carbon	1995	1.79	1.47	NA	**Decreasing**	72
			Total phosphorus	1995	0.24	0.16	18.52	No trend	74
			Transparency	1996	0.42	0.35	NA	No trend	69
		13099	Dissolved oxygen (surface)	1998	11	11	NA	No trend	3
			Nitrate	2023	13.1	13.1	100	NA	1
			Nitrite	2023	0.7	0.7	NA	NA	1
			pH	1998	8.9	8.9	NA	No trend	3
			Temperature	1998	19.2	19.2	NA	No trend	3
			Total Kjeldahl nitrogen	1997	1.24	1.24	NA	No trend	4

Table C15 (continued). Water quality results in Petronila Creek (Upper Laguna Madre system). Parameters with exceedances in over 20% of samples from the previous seven years are highlighted in red. Significant trends are bolded.

Waterbody name	Segment ID	Station ID	Parameter name	First year sampled	Arithmetic mean (3 years)	Geometric mean (3 years)	Percent exceedance (7 years)	Trend (10+ years)	Total sample size
Petronila Creek	2204	13099	Total phosphorus	1997	0.18	0.18	0	No trend	4
			Transparency	1998	0.08	0.08	NA	No trend	3
		18484	Ammonia	2020	0.1	0.08	0	NA	11
			Chlorophyll a	2020	31.66	21.24	45.45	NA	11
			Dissolved oxygen (surface)	2014	9.48	9.07	NA	No trend	30
			Nitrate	2020	5.14	2.14	72.73	NA	11
			Nitrite	2020	1.12	0.05	NA	NA	11
			pH	2014	7.58	7.58	NA	No trend	30
			Temperature	2014	24.93	24.49	NA	No trend	30
			Total Kjeldahl nitrogen	2020	1.25	1.12	NA	NA	11
			Total phosphorus	2020	0.09	0.07	0	NA	11
			Transparency	2014	0.35	0.31	NA	No trend	31
		18642	Ammonia	2020	0.09	0.07	0	NA	11
			Chlorophyll a	2020	15.12	9.66	27.27	NA	11
			Dissolved oxygen (surface)	2014	5.32	4.76	NA	**Decreasing**	31
			Nitrate	2020	3.44	0.44	36.36	NA	11
			Nitrite	2020	0.07	0.02	NA	NA	11
			pH	2014	7.6	7.6	NA	No trend	31
			Temperature	2014	23.24	22.6	NA	No trend	31
			Total Kjeldahl nitrogen	2020	1	0.89	NA	NA	11
			Total phosphorus	2020	0.12	0.08	0	NA	11
			Transparency	2014	0.3	0.28	NA	No trend	31

Table C15 (continued). Water quality results in Petronila Creek (Upper Laguna Madre system). Parameters with exceedances in over 20% of samples from the previous seven years are highlighted in red. Significant trends are bolded.

Waterbody name	Segment ID	Station ID	Parameter name	First year sampled	Arithmetic mean (3 years)	Geometric mean (3 years)	Percent exceedance (7 years)	Trend (10+ years)	Total sample size
Petronila Creek	2204	20806	Alkalinity	2010	144.2	140.86	NA	No trend	51
			Ammonia	2010	0.05	0.05	0	No trend	50
			Chlorophyll a	2010	25.62	15.85	65.38	**Increasing**	51
			Dissolved oxygen (surface)	2010	5.3	4.76	NA	No trend	51
			Nitrate	2018	0.2	0.07	5	NA	20
			Nitrite	2019	0.02	0.02	NA	NA	16
			pH	2010	7.69	7.69	NA	No trend	51
			Temperature	2010	23.21	22.65	NA	No trend	51
			Total Kjeldahl nitrogen	2011	0.85	0.72	NA	No trend	43
			Total organic carbon	2010	8.32	8.14	NA	No trend	50
			Total phosphorus	2010	0.87	0.81	65.38	No trend	51
			Transparency	2010	0.2	0.18	NA	No trend	50
		21594	Ammonia	2020	0.05	0.05	0	NA	10
			Chlorophyll a	2020	14.7	7.32	20	NA	10
			Dissolved oxygen (surface)	2014	8.6	8.38	NA	No trend	30
			Nitrate	2020	0.3	0.16	0	NA	10
			Nitrite	2020	0.01	0.01	NA	NA	10
			pH	2014	8.15	8.14	NA	**Increasing**	30
			Temperature	2014	22.55	21.91	NA	No trend	30
			Total Kjeldahl nitrogen	2020	0.98	0.76	NA	NA	10
			Total phosphorus	2020	0.21	0.14	0	NA	10
			Transparency	2014	0.22	0.18	NA	No trend	30

Table C15 (continued). Water quality results in Petronila Creek (Upper Laguna Madre system). Parameters with exceedances in over 20% of samples from the previous seven years are highlighted in red. Significant trends are bolded.

Waterbody name	Segment ID	Station ID	Parameter name	First year sampled	Arithmetic mean (3 years)	Geometric mean (3 years)	Percent exceedance (7 years)	Trend (10+ years)	Total sample size
Petronila Creek	2204	21596	Ammonia	2021	0.12	0.1	0	NA	8
			Chlorophyll a	2021	20.06	13.71	37.5	NA	8
			Dissolved oxygen (bottom)	2014	23.1	23.1	NA	No trend	2
			Dissolved oxygen (surface)	2014	8.33	7.56	NA	No trend	27
			Nitrate	2021	4.53	2.38	87.5	NA	8
			Nitrite	2021	0.08	0.03	NA	NA	8
			pH	2014	7.39	7.39	NA	No trend	27
			Temperature	2014	25.03	24.82	NA	No trend	27
			Total Kjeldahl nitrogen	2021	1.39	1.23	NA	NA	8
			Total phosphorus	2021	0.06	0.05	0	NA	8
			Transparency	2014	0.49	0.42	NA	No trend	27
		21598	Ammonia	2020	0.06	0.06	0	NA	11
			Chlorophyll a	2020	4.98	3.43	0	NA	11
			Dissolved oxygen (surface)	2014	5.31	4.62	NA	**Decreasing**	31
			Nitrate	2020	5.22	1.03	45.45	NA	11
			Nitrite	2020	0.02	0.01	NA	NA	11
			pH	2014	7.84	7.84	NA	No trend	31
			Temperature	2014	22.34	21.86	NA	No trend	31
			Total Kjeldahl nitrogen	2020	1.17	1.08	NA	NA	11
			Total phosphorus	2020	0.07	0.06	0	NA	11
			Transparency	2014	0.37	0.32	NA	**Decreasing**	31

Table C15 (continued). Water quality results in Petronila Creek (Upper Laguna Madre system). Parameters with exceedances in over 20% of samples from the previous seven years are highlighted in red. Significant trends are bolded.

Waterbody name	Segment ID	Station ID	Parameter name	First year sampled	Arithmetic mean (3 years)	Geometric mean (3 years)	Percent exceedance (7 years)	Trend (10+ years)	Total sample size
Petronila Creek	2204	21929	Ammonia	2021	0.26	0.15	11.11	NA	9
			Chlorophyll a	2021	109.39	10.75	22.22	NA	9
			Dissolved oxygen (surface)	2016	7.36	7.24	NA	NA	20
			Nitrate	2021	5.45	1.94	55.56	NA	9
			Nitrite	2021	0.06	0.02	NA	NA	9
			pH	2016	7.82	7.81	NA	NA	21
			Temperature	2016	23.15	22.85	NA	NA	21
			Total Kjeldahl nitrogen	2021	1.84	1.44	NA	NA	9
			Total phosphorus	2021	0.09	0.07	0	NA	9
			Transparency	2016	0.3	0.25	NA	NA	21
		21931	Ammonia	2020	0.07	0.06	0	NA	7
			Chlorophyll a	2020	28.17	6.07	28.57	NA	7
			Dissolved oxygen (surface)	2016	8.11	7.9	NA	NA	18
			Nitrate	2020	2.74	0.73	57.14	NA	7
			Nitrite	2020	0.15	0.03	NA	NA	7
			pH	2016	7.97	7.96	NA	NA	18
			Temperature	2016	24.29	23.94	NA	NA	18
			Total Kjeldahl nitrogen	2020	1.26	1.16	NA	NA	7
			Total phosphorus	2020	0.12	0.1	0	NA	7
			Transparency	2016	0.22	0.19	NA	NA	18

Table C15 (continued). Water quality results in Petronila Creek (Upper Laguna Madre system). Parameters with exceedances in over 20% of samples from the previous seven years are highlighted in red. Significant trends are bolded.

Waterbody name	Segment ID	Station ID	Parameter name	First year sampled	Arithmetic mean (3 years)	Geometric mean (3 years)	Percent exceedance (7 years)	Trend (10+ years)	Total sample size
Petronila Creek	2204B	13030	Ammonia	2020	0.07	0.06	0	NA	11
			Chlorophyll a	2020	37.29	17.92	45.45	NA	11
			Dissolved oxygen (surface)	2014	6.12	5.89	NA	**Decreasing**	31
			Nitrate	2020	4	0.84	45.45	NA	11
			Nitrite	2020	0.5	0.03	NA	NA	11
			pH	2014	7.94	7.94	NA	No trend	31
			Temperature	2014	23.35	22.84	NA	No trend	31
			Total Kjeldahl nitrogen	2020	1.48	1.2	NA	NA	11
			Total phosphorus	2020	0.08	0.07	0	NA	11
			Transparency	2014	0.36	0.35	NA	No trend	31

Table C16. Water quality results in San Fernando Creek (Upper Laguna Madre system). Parameters with exceedances in over 20% of samples from the previous seven years are highlighted in red. Significant trends are bolded.

Waterbody name	Segment ID	Station ID	Parameter name	First year sampled	Arithmetic mean (3 years)	Geometric mean (3 years)	Percent exceedance (7 years)	Trend (10+ years)	Total sample size
San Fernando Creek	2492A	13033	Alkalinity	1969	328.2	305.25	NA	No trend	156
			Ammonia	1969	0.09	0.08	4	**Decreasing**	190
			Chlorophyll a	1972	38.72	15.14	38.46	No trend	169
			Dissolved oxygen (surface)	1969	8.81	8.59	NA	**Increasing**	192
			Enterococci	2001	4400	4400	100	**Increasing**	36
			Nitrate	1969	2.09	1.46	55	No trend	113
			Nitrite	1969	0.18	0.07	NA	**Decreasing**	67
			pH	1969	8.2	8.2	NA	**Increasing**	183
			Temperature	1969	21.57	20.86	NA	No trend	196
			Total Kjeldahl nitrogen	1993	1.39	1.27	NA	No trend	94
			Total organic carbon	1974	6.2	5.45	NA	**Decreasing**	161
			Total phosphorus	1969	2.7	2.61	100	No trend	187
			Transparency	1990	0.15	0.14	NA	**Decreasing**	115
		15969	Dissolved oxygen (surface)	2023	10.1	10.1	NA	NA	1
			Nitrate	2023	0.07	0.07	0	NA	1
			Nitrite	2023	0.53	0.53	NA	NA	1
			pH	2023	8.2	8.2	NA	NA	1
			Temperature	2023	17.2	17.2	NA	NA	1
			Total phosphorus	2023	2.3	2.3	100	NA	1
			Transparency	2023	0.1	0.1	NA	NA	1

Table C16 (continued). Water quality results in San Fernando Creek (Upper Laguna Madre system). Parameters with exceedances in over 20% of samples from the previous seven years are highlighted in red. Significant trends are bolded.

Waterbody name	Segment ID	Station ID	Parameter name	First year sampled	Arithmetic mean (3 years)	Geometric mean (3 years)	Percent exceedance (7 years)	Trend (10+ years)	Total sample size
San Fernando Creek	2492A	15971	Dissolved oxygen (surface)	2023	8.2	8.2	NA	NA	1
			Nitrate	2023	3.64	3.64	100	NA	1
			Nitrite	2023	0.11	0.11	NA	NA	1
			pH	2023	8	8	NA	NA	1
			Temperature	2023	16.8	16.8	NA	NA	1
			Total phosphorus	2023	1.5	1.5	100	NA	1
			Transparency	2023	0.6	0.6	NA	NA	1
		15972	Dissolved oxygen (surface)	2023	9.2	9.2	NA	NA	1
			Nitrate	2023	0.01	0.01	0	NA	1
			Nitrite	2023	0.01	0.01	NA	NA	1
			pH	2023	7.8	7.8	NA	NA	1
			Temperature	2023	16.6	16.6	NA	NA	1
			Total phosphorus	2023	0.16	0.16	0	NA	1
			Transparency	2023	0.36	0.36	NA	NA	1
		15975	Dissolved oxygen (surface)	2023	6.6	6.6	NA	NA	1
			Nitrate	2023	0.09	0.09	0	NA	1
			pH	2023	7.8	7.8	NA	NA	1
			Temperature	2023	17.7	17.7	NA	NA	1
			Total Kjeldahl nitrogen	2023	1.14	1.14	NA	NA	1
			Total phosphorus	2023	4.1	4.1	100	NA	1
			Transparency	2023	0.24	0.24	NA	NA	1

Table C16 (continued). Water quality results in San Fernando Creek (Upper Laguna Madre system). Parameters with exceedances in over 20% of samples from the previous seven years are highlighted in red. Significant trends are bolded.

Waterbody name	Segment ID	Station ID	Parameter name	First year sampled	Arithmetic mean (3 years)	Geometric mean (3 years)	Percent exceedance (7 years)	Trend (10+ years)	Total sample size
San Fernando Creek	2492A	22327	Nitrate	2023	0.8	0.8	0	NA	1
			Nitrite	2023	0.02	0.02	NA	NA	1
			pH	2023	7.6	7.6	NA	NA	1
			Temperature	2023	16.8	16.8	NA	NA	1
			Total Kjeldahl nitrogen	2023	0.91	0.91	NA	NA	1
			Total phosphorus	2023	2.5	2.5	100	NA	1
			Transparency	2023	0.17	0.17	NA	NA	1

Table C17. Water quality results in Los Olmos Creek (Upper Laguna Madre system). Parameters with exceedances in over 20% of samples from the previous seven years are highlighted in red. Significant trends are bolded.

Waterbody name	Segment ID	Station ID	Parameter name	First year sampled	Arithmetic mean (3 years)	Geometric mean (3 years)	Percent exceedance (7 years)	Trend (10+ years)	Total sample size
Los Olmos Creek	2492B	13034	Alkalinity	1995	168.81	167.64	NA	No trend	18
			Ammonia	1971	0.19	0.12	5.56	No trend	27
			Chlorophyll a	1972	63.48	37.01	78.95	No trend	27
			Dissolved oxygen (surface)	1971	5.65	5.47	NA	No trend	27
			Nitrate	1971	10.34	1.57	44.44	**Increasing**	26
			Nitrite	2019	1.77	0.14	NA	NA	15
			pH	1972	8.55	8.55	NA	No trend	26
			Salinity	2018	52.08	44.94	NA	NA	19
			Temperature	1971	21.75	20.94	NA	No trend	27
			Total Kjeldahl nitrogen	1995	3.4	2.98	NA	No trend	20
			Total organic carbon	1995	1.11	0.97	NA	**Decreasing**	20
			Total phosphorus	1971	0.44	0.41	5.26	**Increasing**	28
			Transparency	2018	0.09	0.09	NA	NA	19

Table C18. Water quality results in Laguna Madre (Upper Laguna Madre system). Parameters with exceedances in over 20% of samples from the previous seven years are highlighted in red. Significant trends are bolded.

Waterbody name	Segment ID	Station ID	Parameter name	First year sampled	Arithmetic mean (3 years)	Geometric mean (3 years)	Percent exceedance (7 years)	Trend (10+ years)	Total sample size
Laguna Madre	2491	13445	Alkalinity	1976	145.25	143.87	NA	No trend	169
			Ammonia	1973	0.05	0.04	18.75	**Decreasing**	178
			Chlorophyll a	1973	13.26	10.91	26.67	**Increasing**	174
			Dissolved oxygen (surface)	1973	6.62	6.38	NA	No trend	180
			Enterococci	2001	5	5	0	No trend	63
			Fluoride	2001	0.6	0.59	NA	**Decreasing**	74
			Nitrite+nitrate	1976	0.05	0.04	6.25	**Decreasing**	121
			pH	1973	8.19	8.19	NA	No trend	177
			Salinity	1985	35.67	35.05	NA	No trend	120
			Temperature	1973	22.86	21.86	NA	No trend	180
			Total Kjeldahl nitrogen	1993	0.85	0.76	NA	**Decreasing**	102
			Total organic carbon	1974	5.34	4.16	NA	No trend	168
			Total phosphorus	1973	0.04	0.04	0	No trend	175
			Transparency	1989	0.84	0.82	NA	No trend	119

Table C19. Water quality results in Baffin Bay (Upper Laguna Madre system). Parameters with exceedances in over 20% of samples from the previous seven years are highlighted in red. Significant trends are bolded.

Waterbody name	Segment ID	Station ID	Parameter name	First year sampled	Arithmetic mean (3 years)	Geometric mean (3 years)	Percent exceedance (7 years)	Trend (10+ years)	Total sample size
Baffin Bay	2492	13450	Alkalinity	1976	154.67	153.93	NA	No trend	160
			Ammonia	1973	0.12	0.06	26.67	**Decreasing**	165
			Chlorophyll a	1973	14.92	14.74	66.67	**Increasing**	164
			Dissolved oxygen (bottom)	1973	7.32	7.15	NA	**Decreasing**	160
			Dissolved oxygen (surface)	1973	7.47	7.3	NA	**Decreasing**	176
			Enterococci	2001	10.62	9.31	0	No trend	59
			Fluoride	2001	0.73	0.65	NA	**Decreasing**	71
			Nitrite+nitrate	1976	0.05	0.04	0	**Decreasing**	115
			pH	1973	8.31	8.31	NA	No trend	173
			Salinity	1985	36.72	35.3	NA	No trend	117
			Temperature	1973	22.85	21.79	NA	No trend	176
			Total Kjeldahl nitrogen	1993	1.1	1.1	NA	**Decreasing**	97
			Total organic carbon	1974	7.36	5.92	NA	No trend	160
			Total phosphorus	1973	0.05	0.04	0	No trend	160
			Transparency	1989	0.62	0.6	NA	**Increasing**	117
		13452	Alkalinity	1976	156.58	155.05	NA	No trend	155
			Ammonia	1973	0.04	0.04	0	**Decreasing**	162
			Chlorophyll a	1973	18.3	18.04	100	**Increasing**	159
			Dissolved oxygen (bottom)	1973	7.18	6.98	NA	No trend	149
			Dissolved oxygen (surface)	1973	7.51	7.36	NA	No trend	167
			Enterococci	2001	13.67	9.19	0	No trend	48

Table C19 (continued). Water quality results in Baffin Bay (Upper Laguna Madre system). Parameters with exceedances in over 20% of samples from the previous seven years are highlighted in red. Significant trends are bolded.

Waterbody name	Segment ID	Station ID	Parameter name	First year sampled	Arithmetic mean (3 years)	Geometric mean (3 years)	Percent exceedance (7 years)	Trend (10+ years)	Total sample size
Baffin Bay	2492	13452	Fluoride	2001	0.74	0.61	NA	**Decreasing**	61
			Nitrite+nitrate	1976	0.02	0.02	0	**Decreasing**	108
			pH	1973	8.34	8.34	NA	No trend	163
			Salinity	1984	36.84	34.74	NA	No trend	107
			Temperature	1973	22.94	21.87	NA	No trend	166
			Total Kjeldahl nitrogen	1984	1.24	1.23	NA	**Decreasing**	89
			Total organic carbon	1974	8.08	6.38	NA	**Decreasing**	151
			Total phosphorus	1973	0.06	0.06	0	No trend	156
			Transparency	1989	0.62	0.6	NA	No trend	106

Appendix D. Boxplots showing water quality parameter summaries.

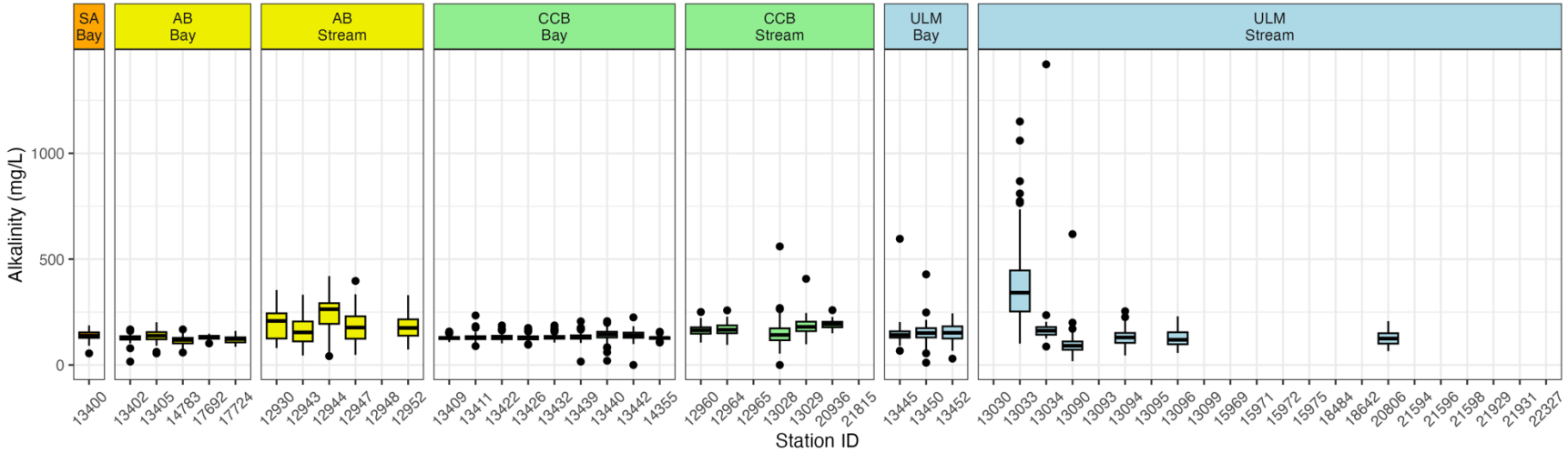

Figure D1. Alkalinity levels at all stations with available data.

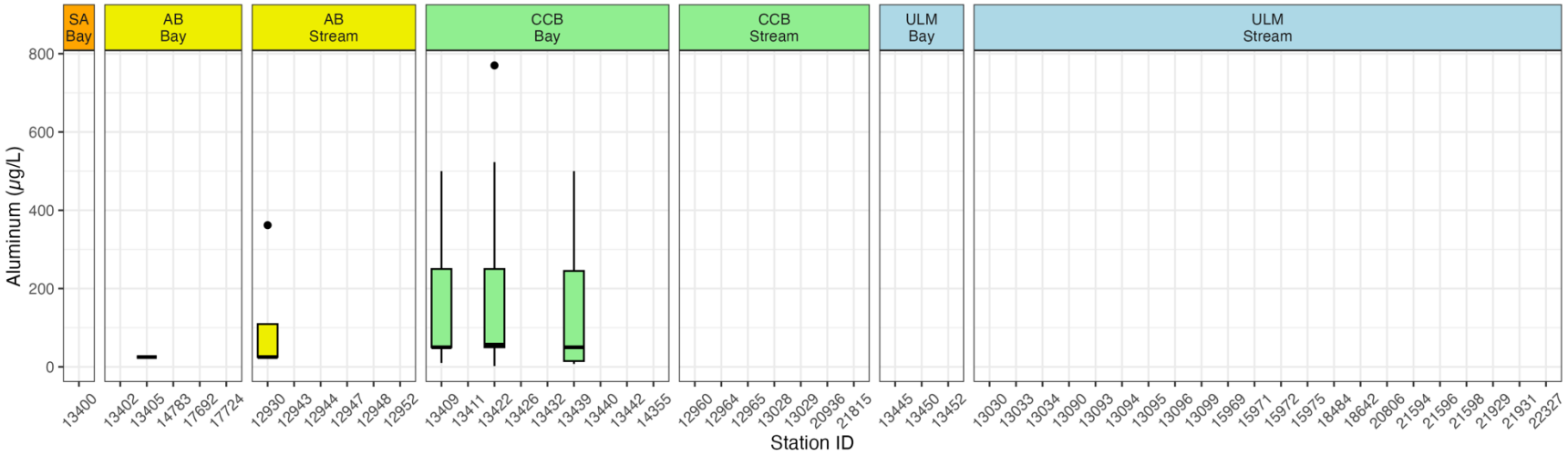

Figure D2. Aluminum levels at all stations with available data.

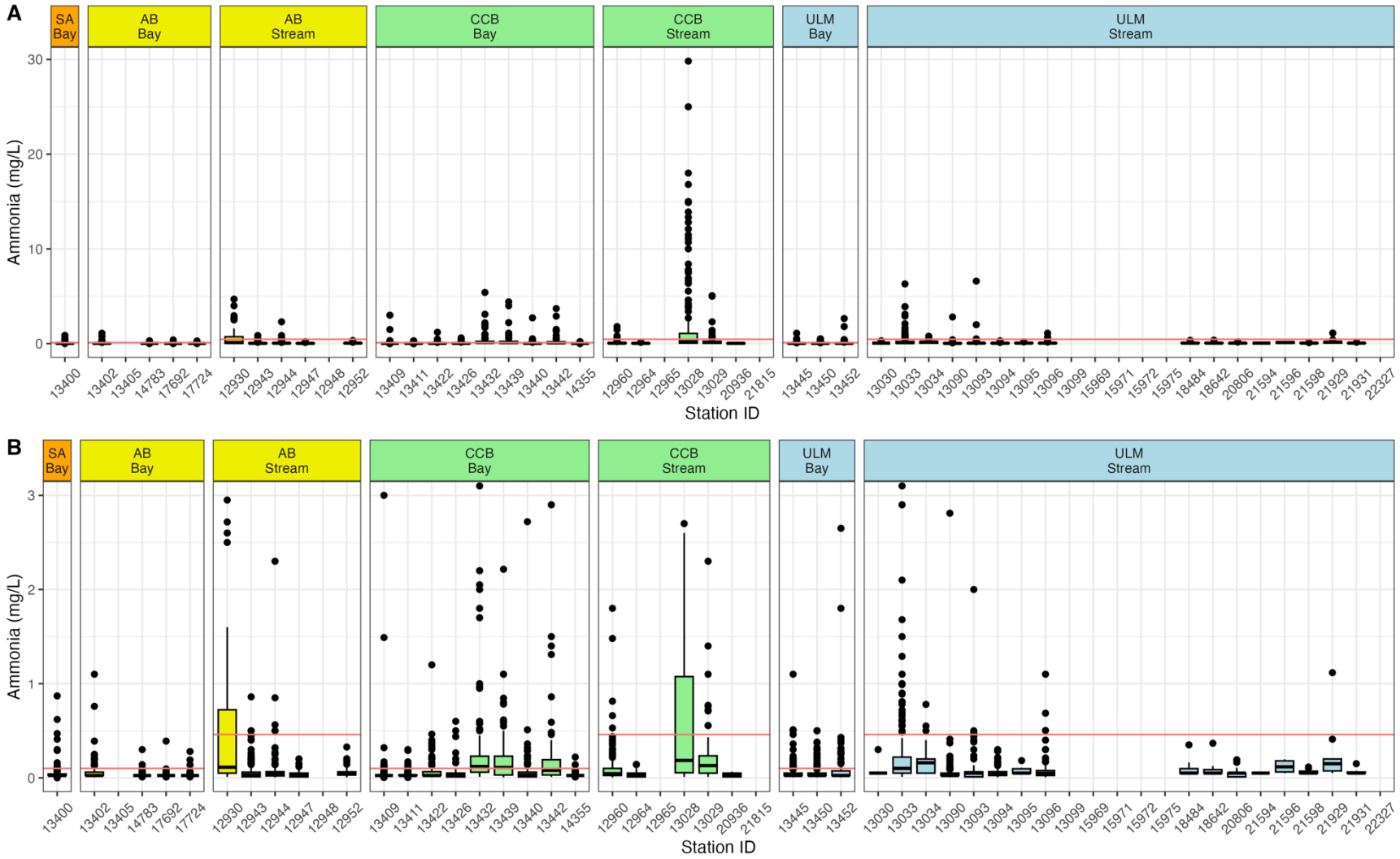

Figure D3. A) Ammonia levels at all stations with available data. The horizontal red line represents the TCEQ screening criteria levels for ammonia (0.1mg/L in bay sites and 0.46mg/L in stream sites). B) Ammonia levels at all stations, zoomed in for a closer look at the data.

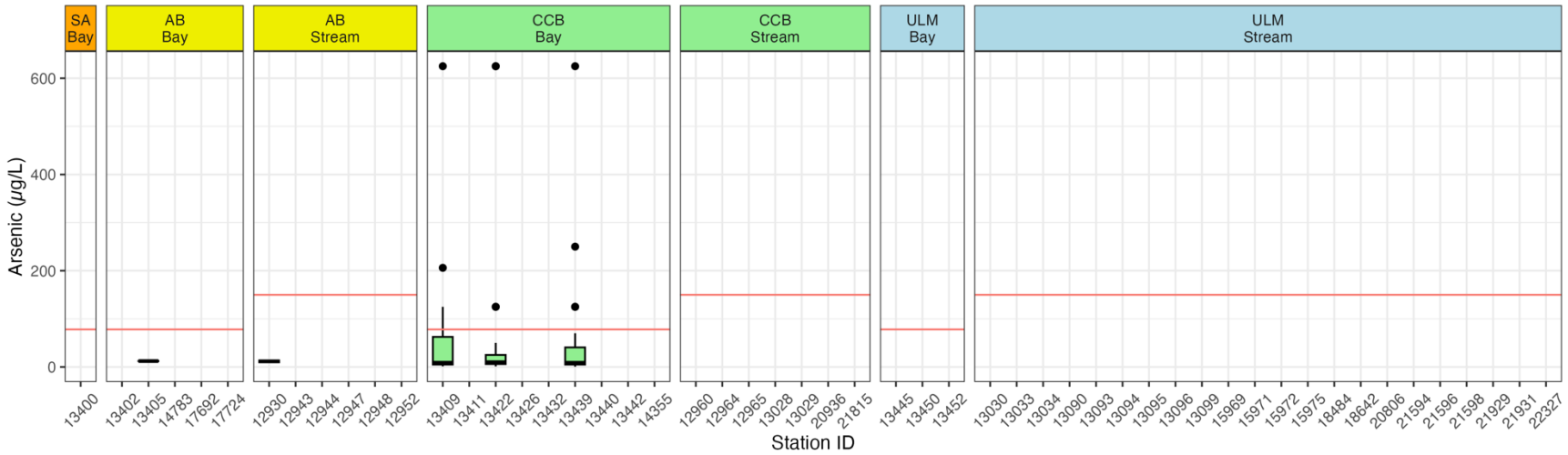

Figure D4. Arsenic levels at all stations with available data. The horizontal red line represents the TCEQ screening criteria levels for arsenic (78µg/L in bay sites and 150µg/L in stream sites). Empty boxplots represent sites with no available data.

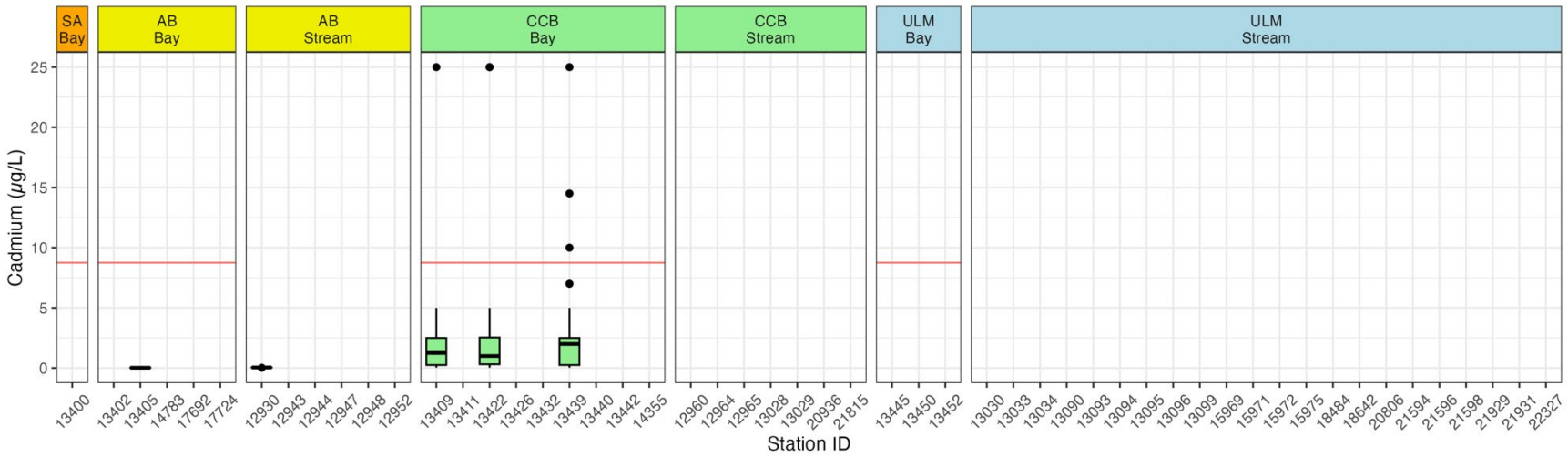

Figure D5. Cadmium levels at all stations with available data. The horizontal red line represents the TCEQ screening criteria levels for cadmium (8.75µg/L in bay sites). Screening criteria are not included for stream sites, as the value is dynamic and calculated based on water hardness, which was not available during this analysis.

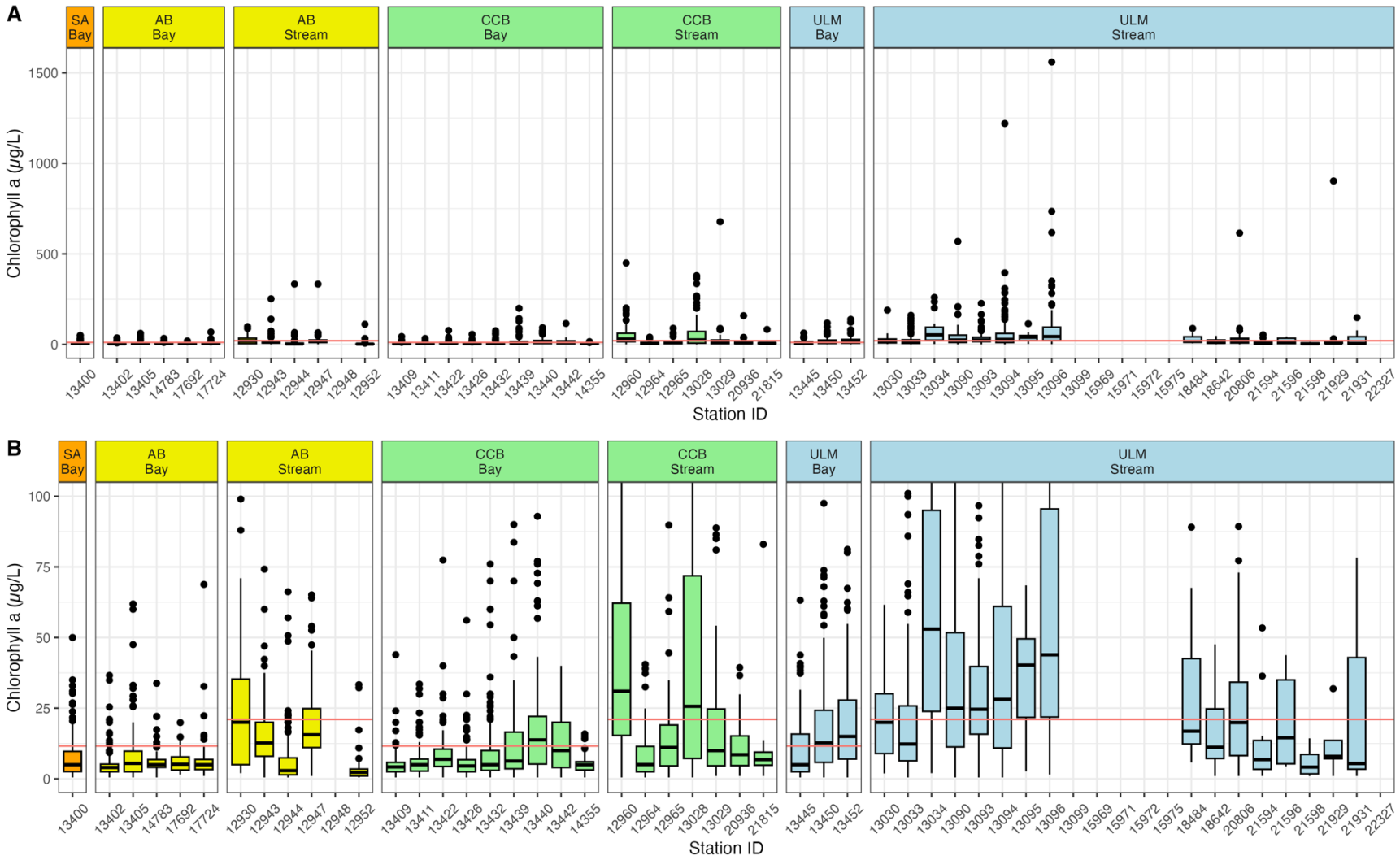

Figure D6. A) Chlorophyll a levels at all stations with available data. The horizontal red line represents the TCEQ screening criteria levels for chlorophyll a (11.6µg/L in bay sites and 21µg/L in stream sites). B) Chlorophyll a levels at all stations, zoomed in for a closer look at the data.

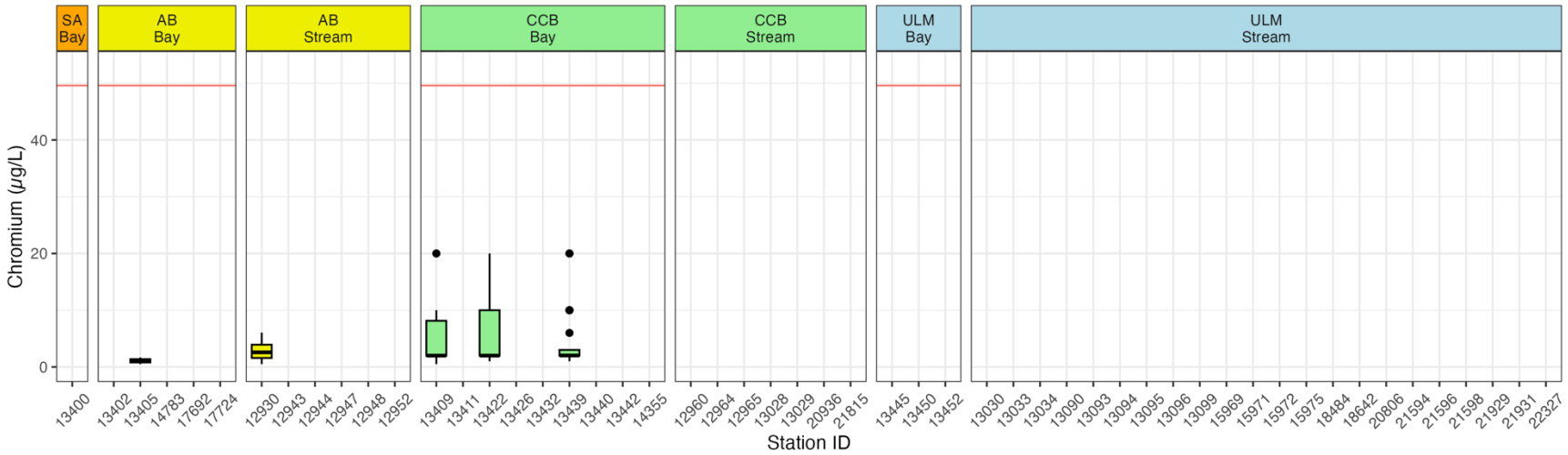

Figure D7. Chromium levels at all stations with available data. The horizontal red line represents the TCEQ screening criteria levels for chromium (49.6µg/L in bay sites). Screening criteria are not included for stream sites, as the value is dynamic and calculated based on water hardness, which was not available during this analysis.

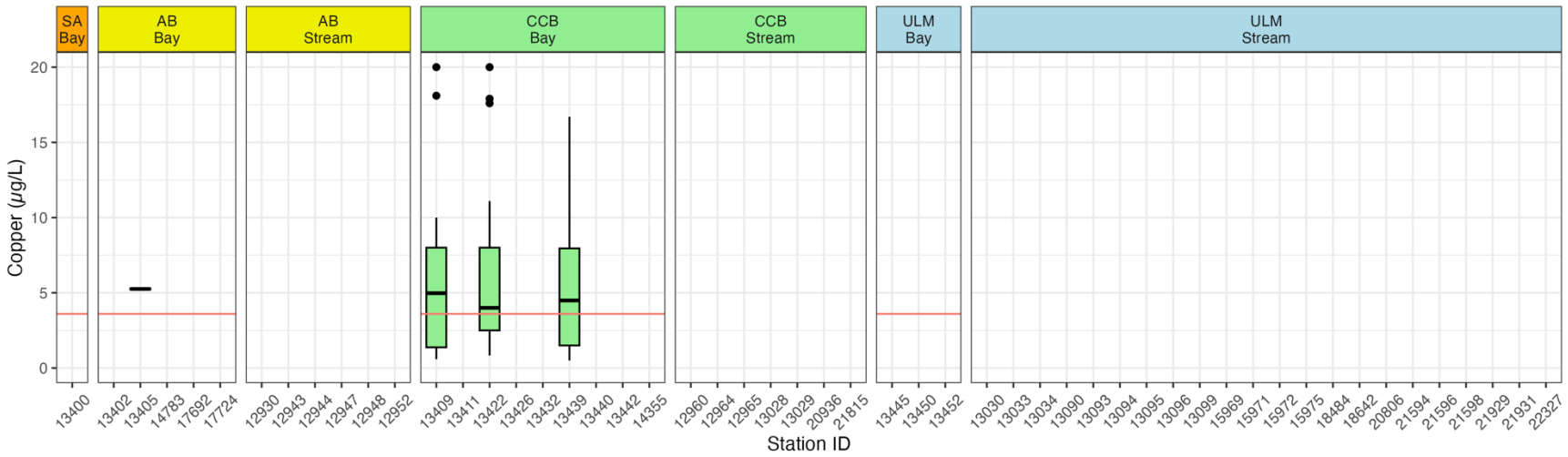

Figure D8. Copper levels at all stations with available data. The horizontal red line represents the TCEQ screening criteria levels for copper (3.6µg/L in bay sites). Screening criteria are not included for stream sites, as the value is dynamic and calculated based on water hardness, which was not available during this analysis.

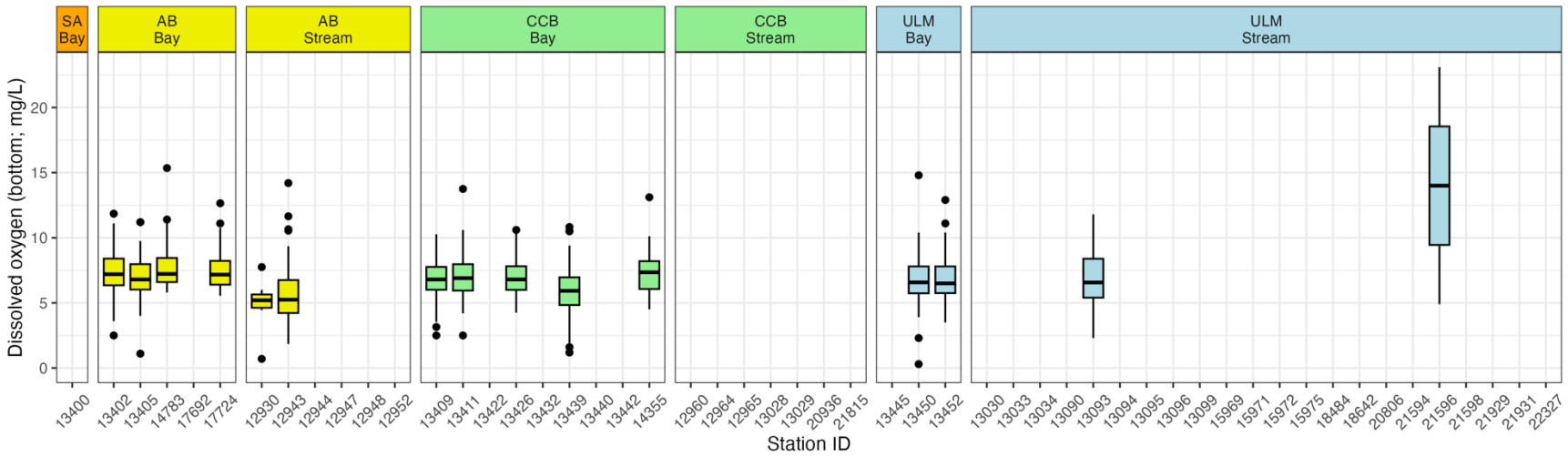

Figure D9. Dissolved oxygen (bottom) levels at all stations with available data.

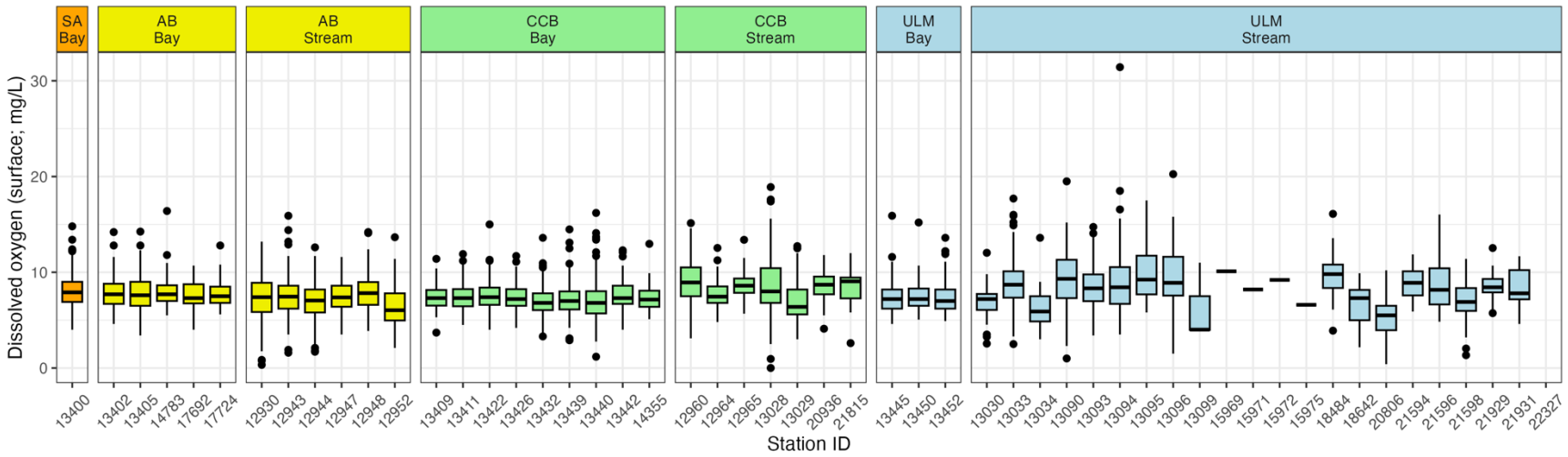

Figure D10. Dissolved oxygen (surface) levels at all stations with available data.

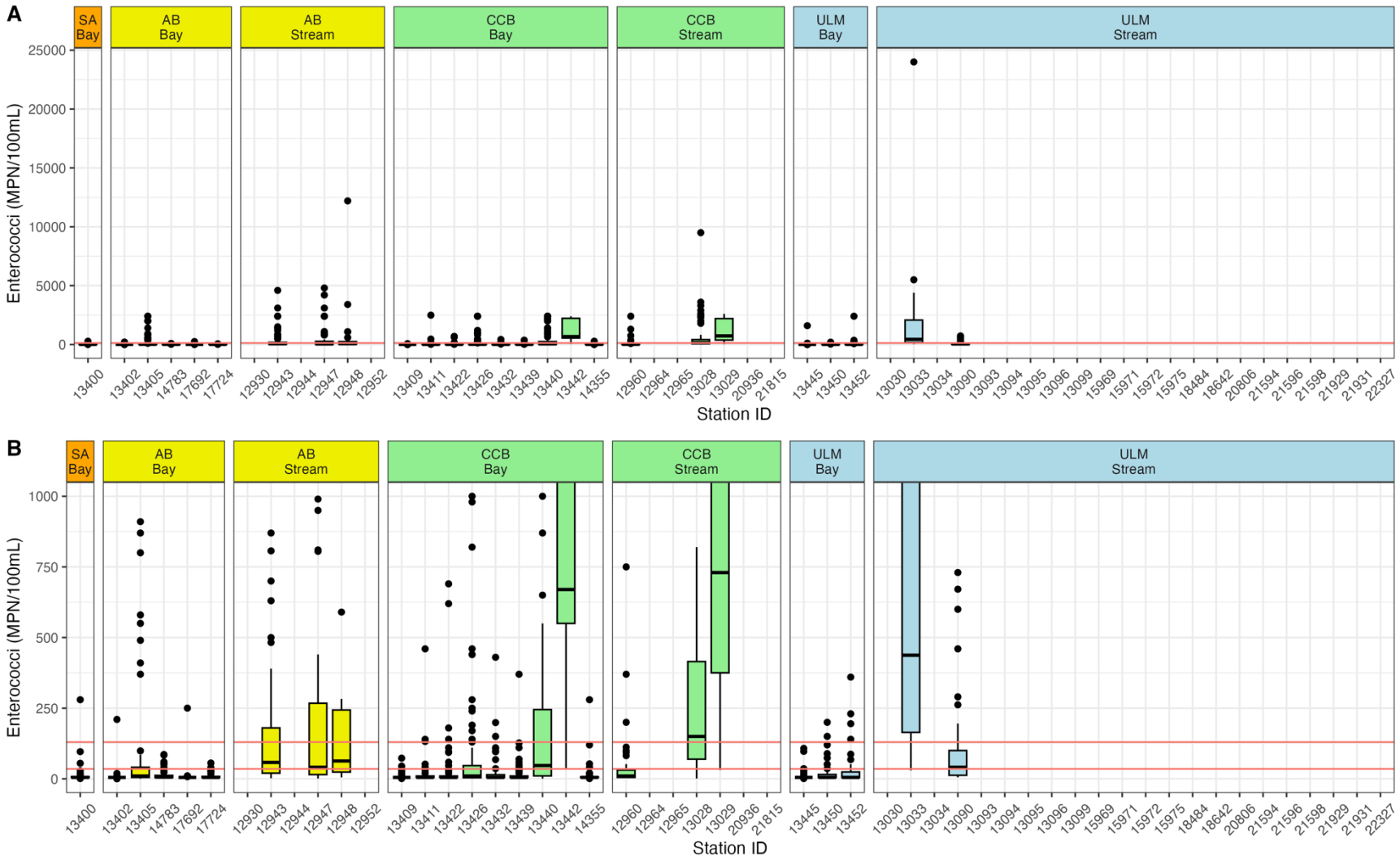

Figure D11. A) Enterococci levels at all stations with available data. The horizontal red lines represent the 2012 EPA screening criteria levels for enterococci in bay and stream sites (top red line: statistical threshold value of 130 MPN/100mL; bottom red line: geometric mean of 35 MPN/100mL). B) Enterococci levels at all stations, zoomed in for a closer look at the data.

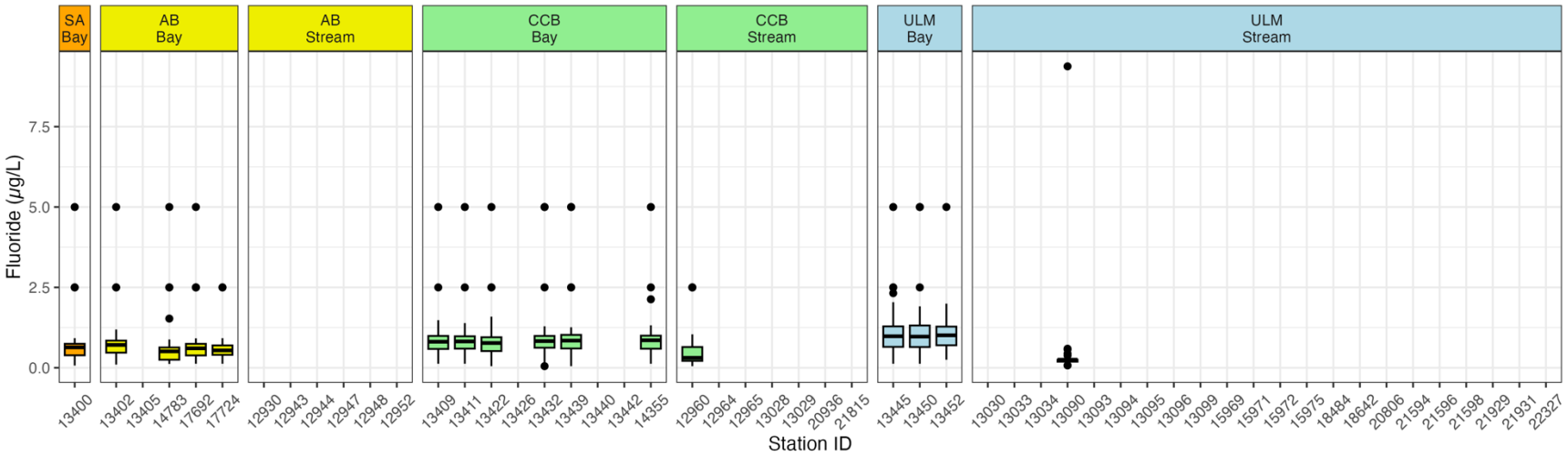

Figure D12. Fluoride levels at all stations with available data.

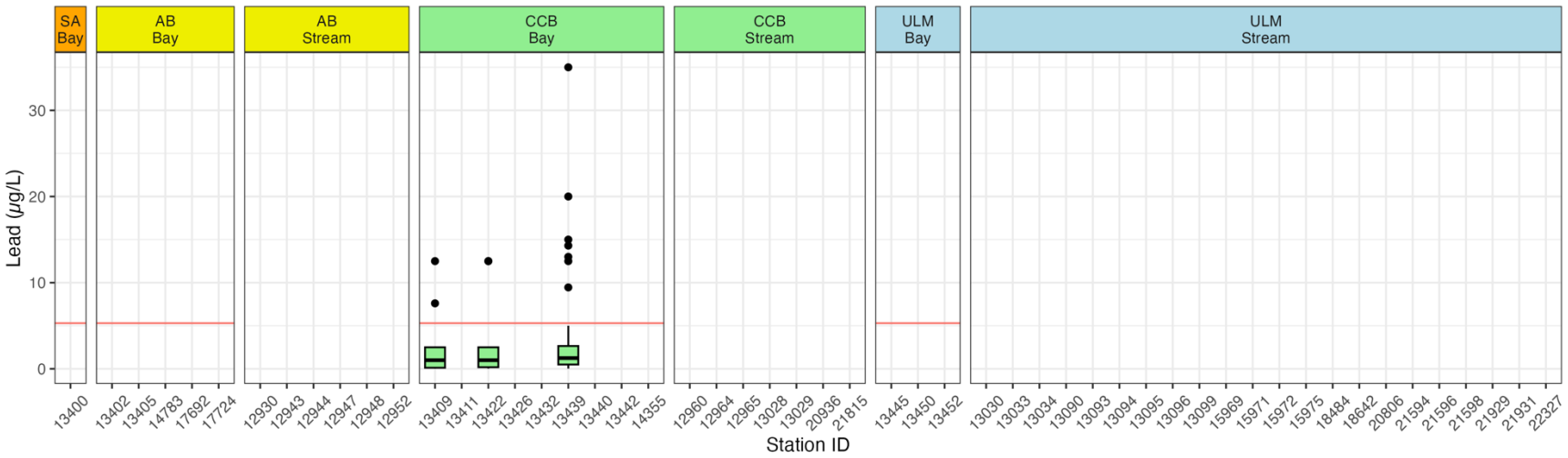

Figure D13. Lead levels at all stations with available data. The horizontal red line represents the TCEQ screening criteria levels for lead (5.3µg/L in bay sites). Screening criteria are not included for stream sites, as the value is dynamic and calculated based on water hardness, which was not available during this analysis.

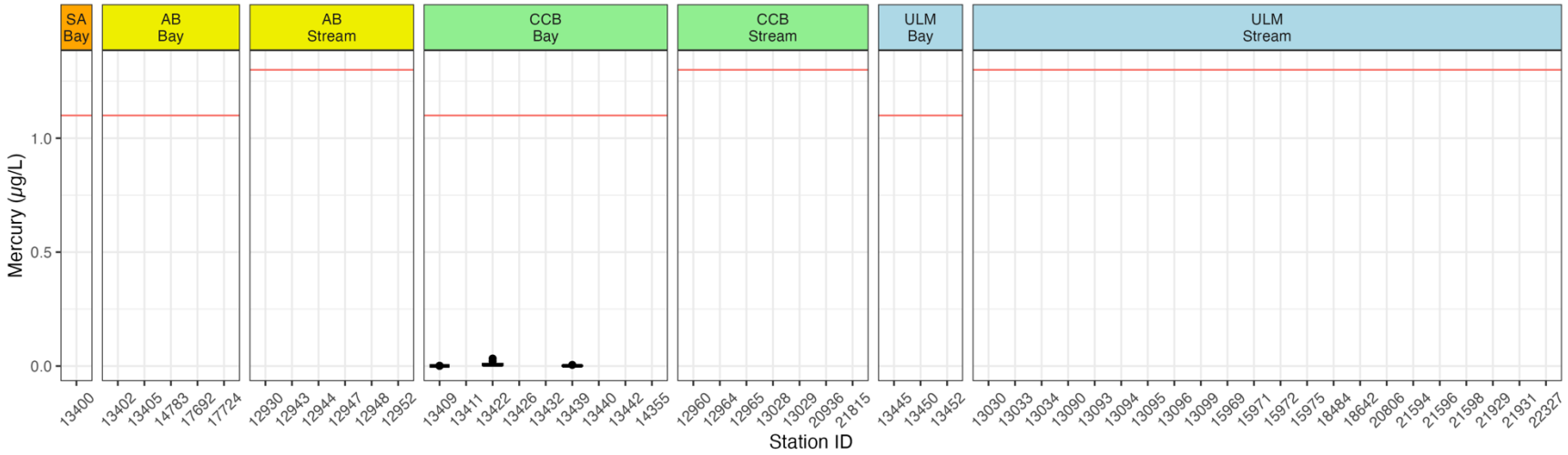

Figure D14. Mercury levels at all stations with available data. The horizontal red line represents the TCEQ screening criteria levels for mercury (1.1µg/L in bay and 1.3 µg/L in stream sites).

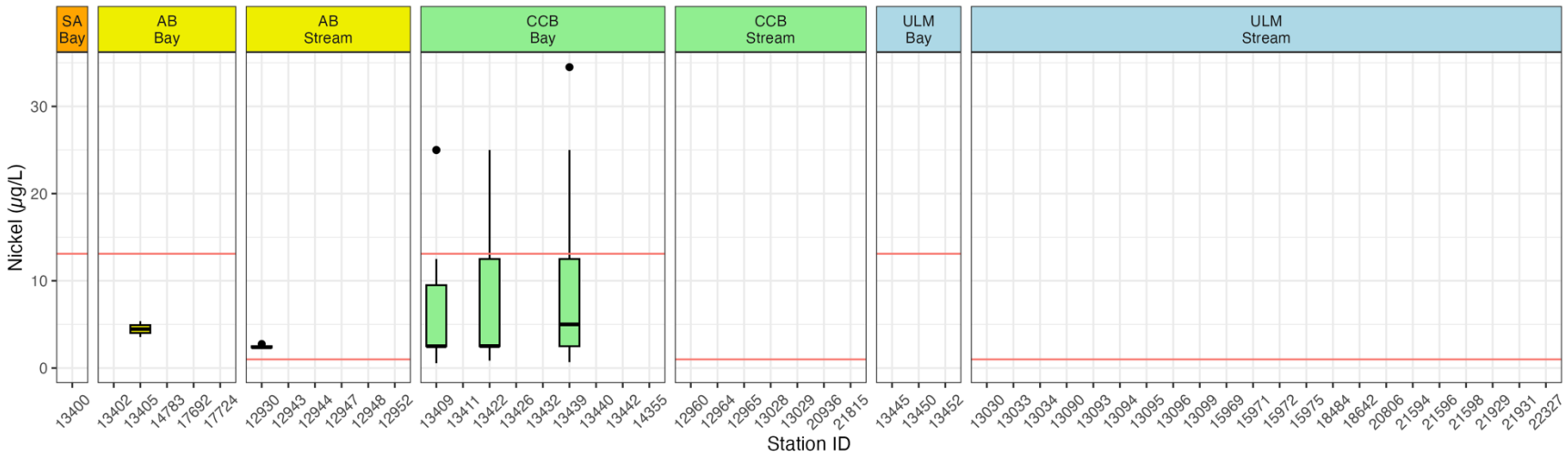

Figure D15. Nickel levels at all stations with available data. The horizontal red line represents the TCEQ screening criteria levels for nickel (13.1µg/L in bay sites and 0.997µg/L in stream sites). The high levels shown in Corpus Christi Bay (stations 13409, 13422, and 13439) were due to censored values with an LOD above the screening criteria.

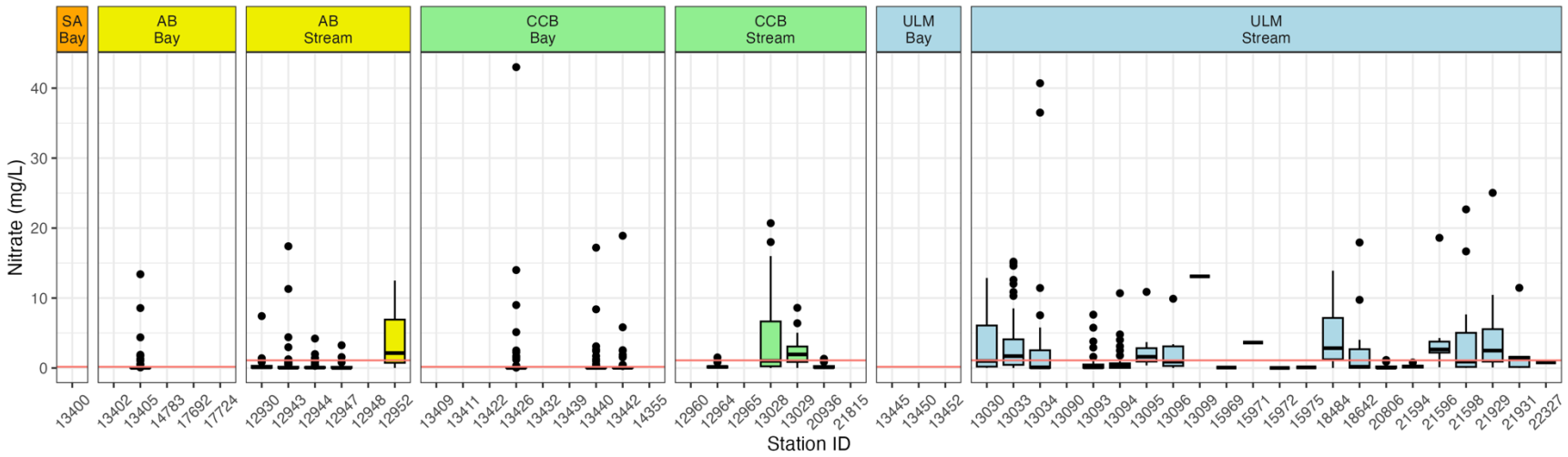

Figure D16. Nitrate levels at all stations with available data. The horizontal red line represents the TCEQ screening criteria levels for nitrate (0.17µg/L in bay sites and 1.1µg/L in stream sites).

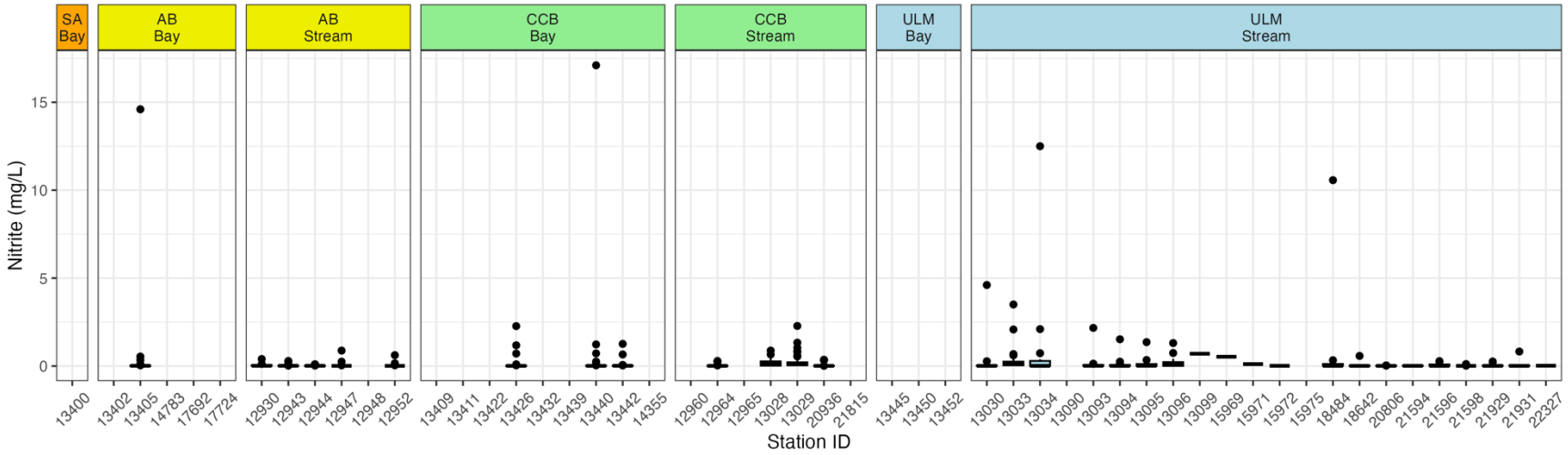

Figure D17. Nitrite levels at all stations with available data.

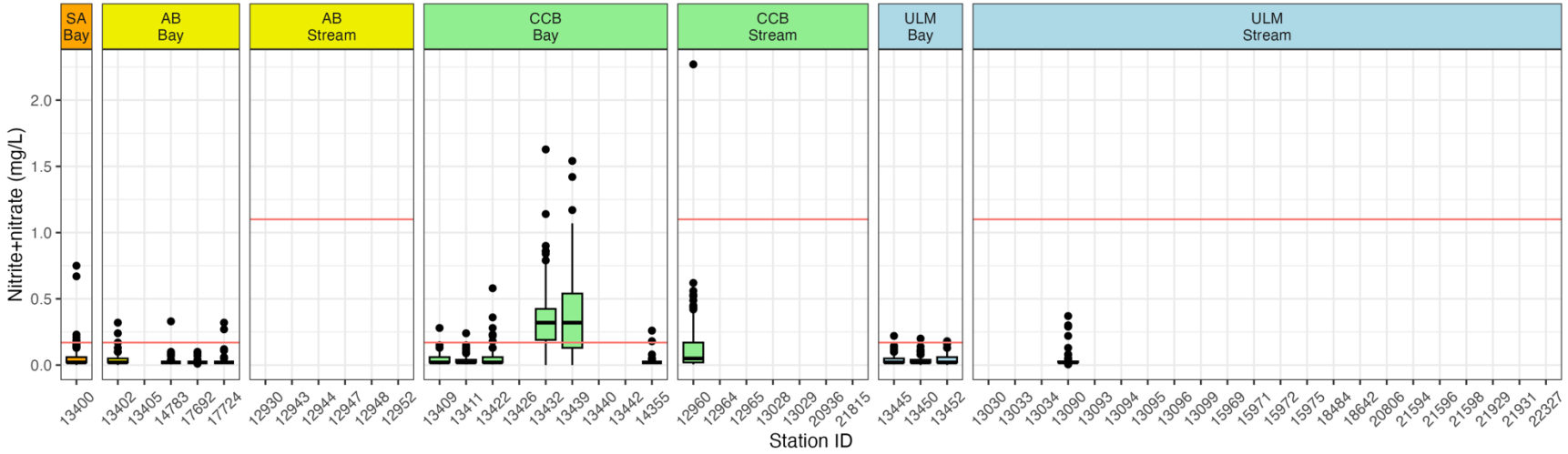

Figure D18. Nitrite+nitrate levels at all stations with available data. The horizontal red line represents the TCEQ screening criteria levels for nitrate (0.17µg/L in bay sites and 1.1µg/L in stream sites).

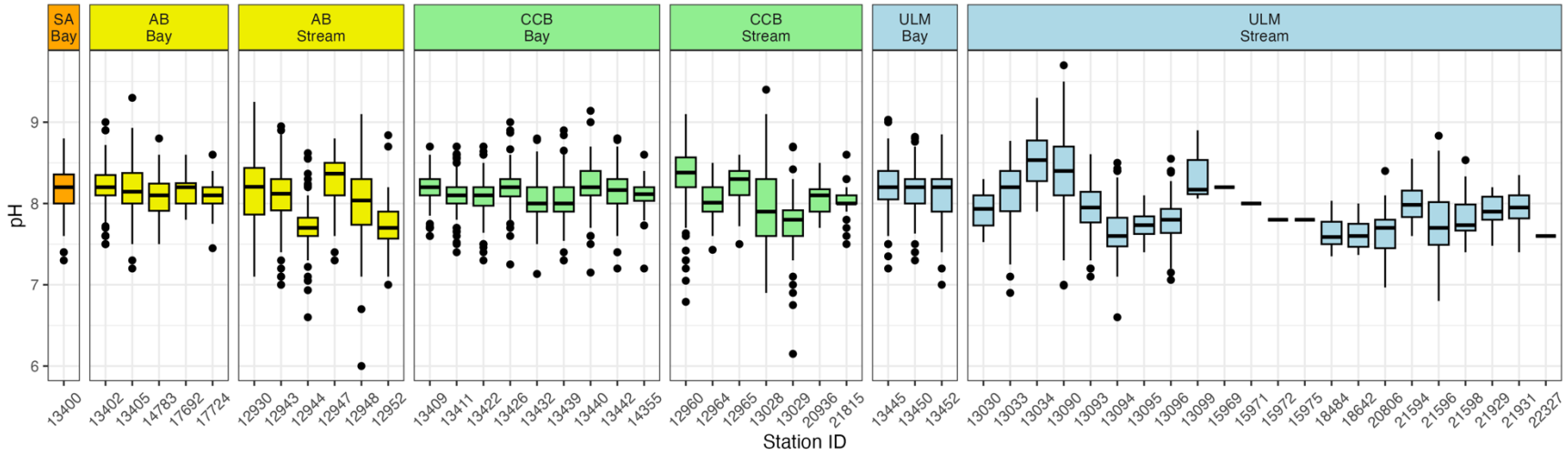

Figure D19. pH levels at all stations with available data.

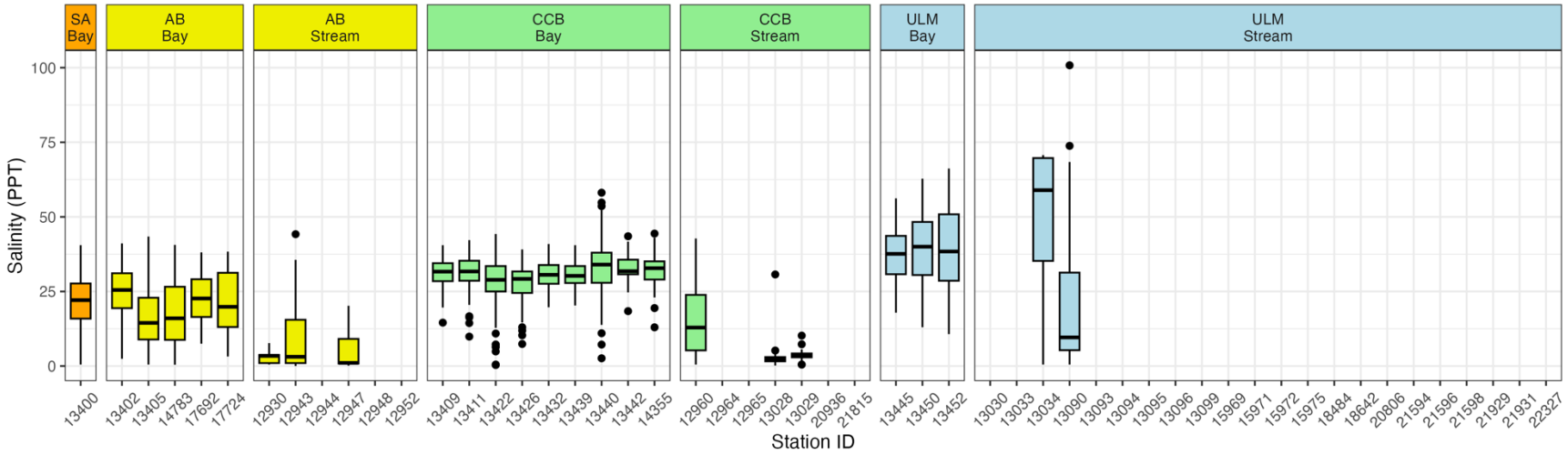

Figure D20. Salinity levels at all stations with available data.

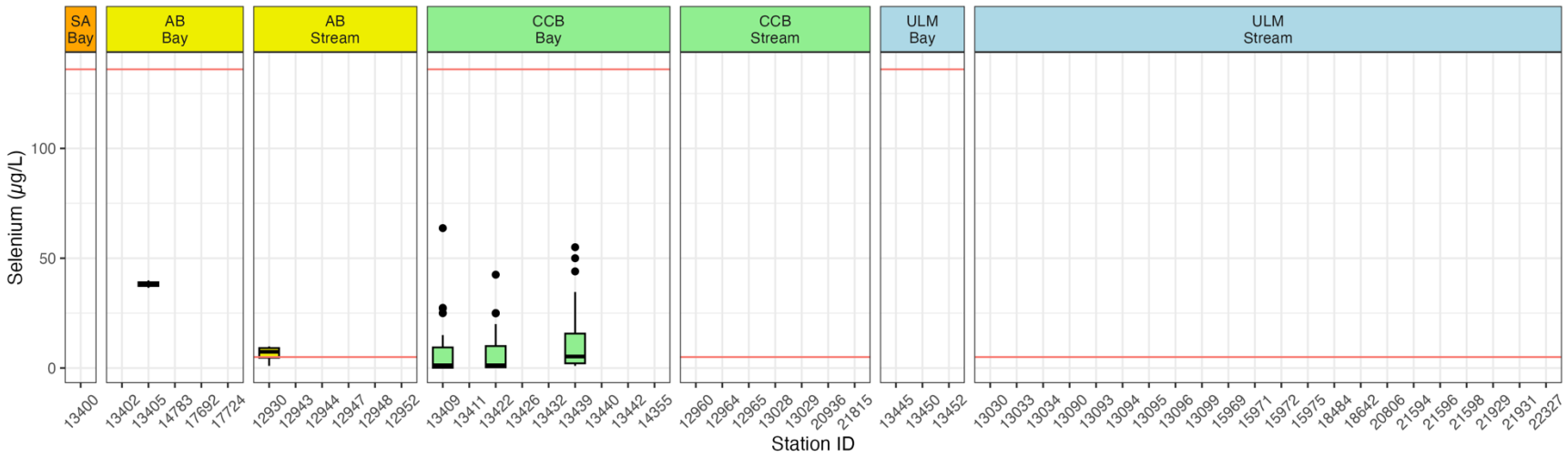

Figure D21. Selenium levels at all stations with available data. The horizontal red line represents the TCEQ screening criteria levels for selenium (136µg/L in bay sites and 5µg/L in stream sites).

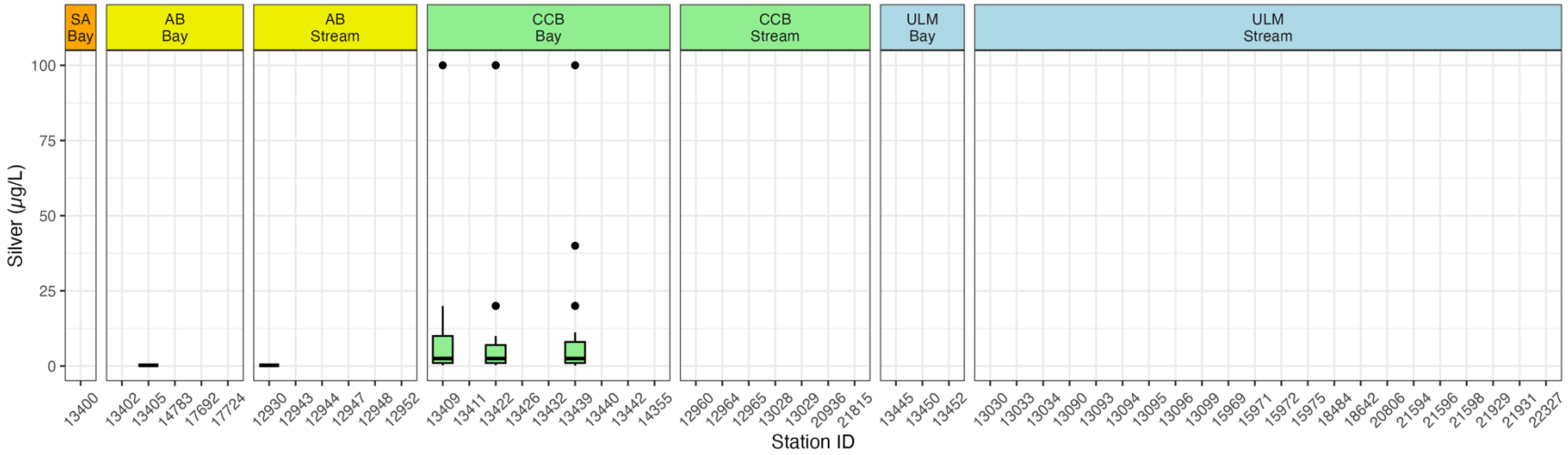

Figure D22. Silver levels at all stations with available data.

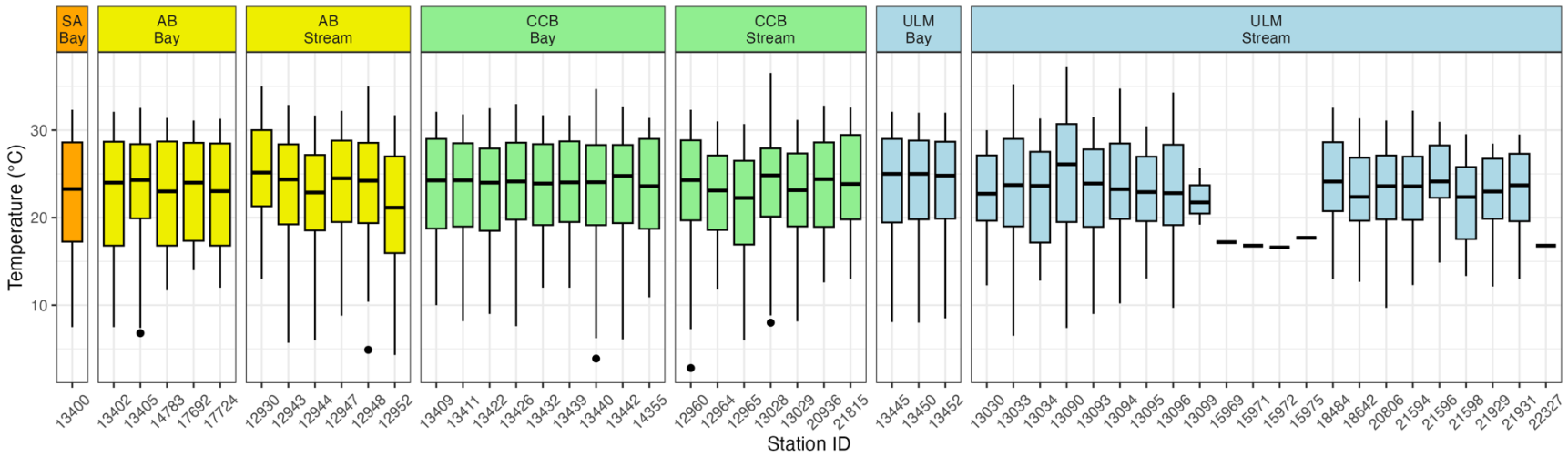

Figure D23. Temperature levels at all stations with available data.

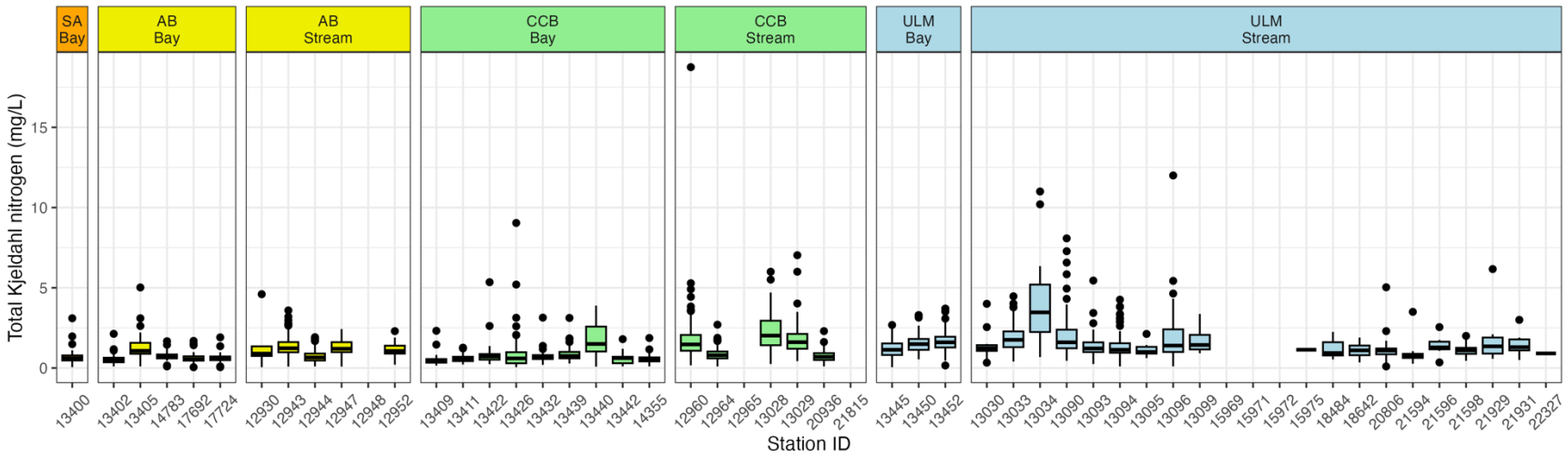

Figure D24. Total Kjeldahl nitrogen levels at all stations with available data.

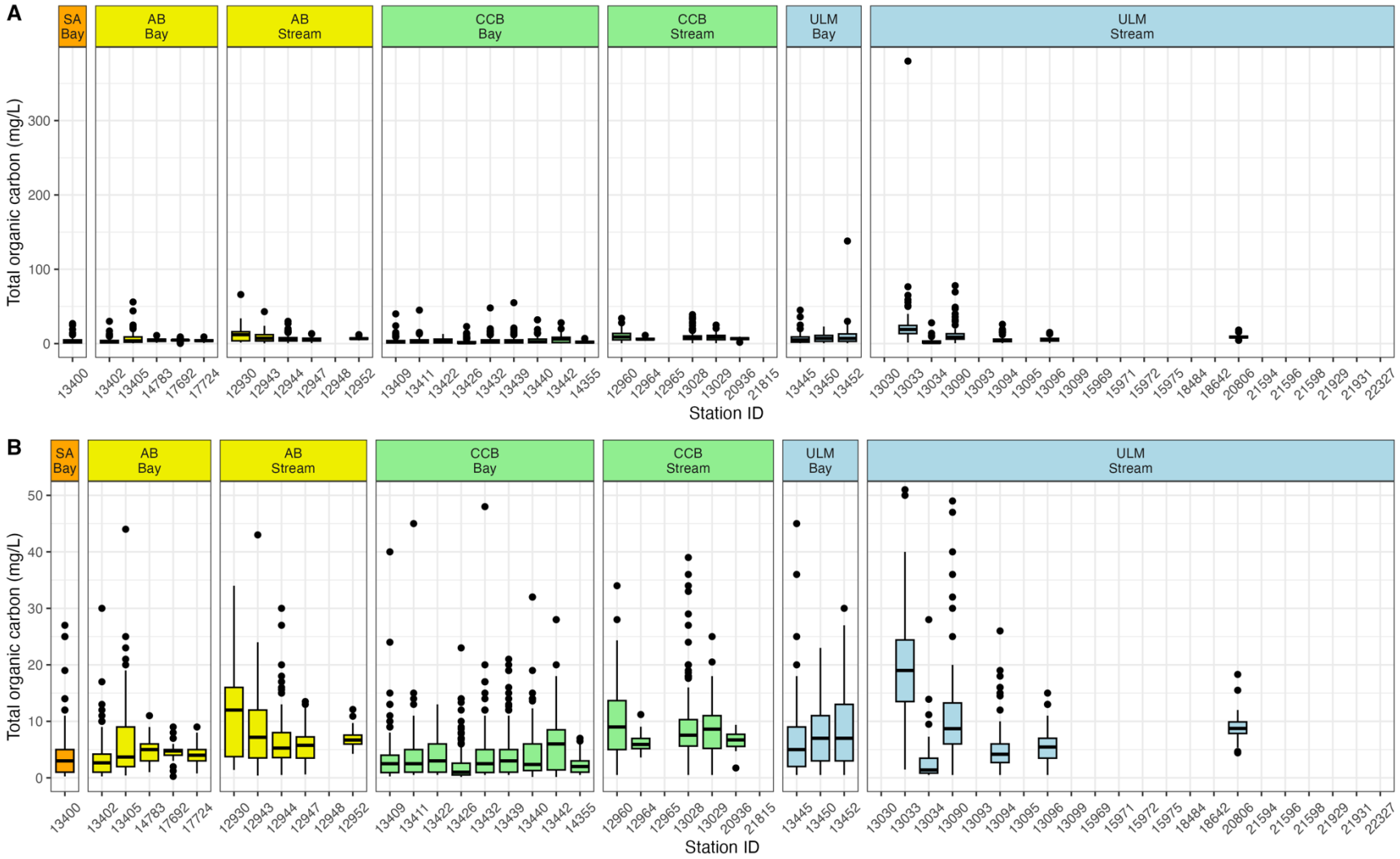

Figure D25. A) Total organic carbon levels at all stations with available data. B) Total organic carbon levels at all stations, zoomed in for a closer look at the data.

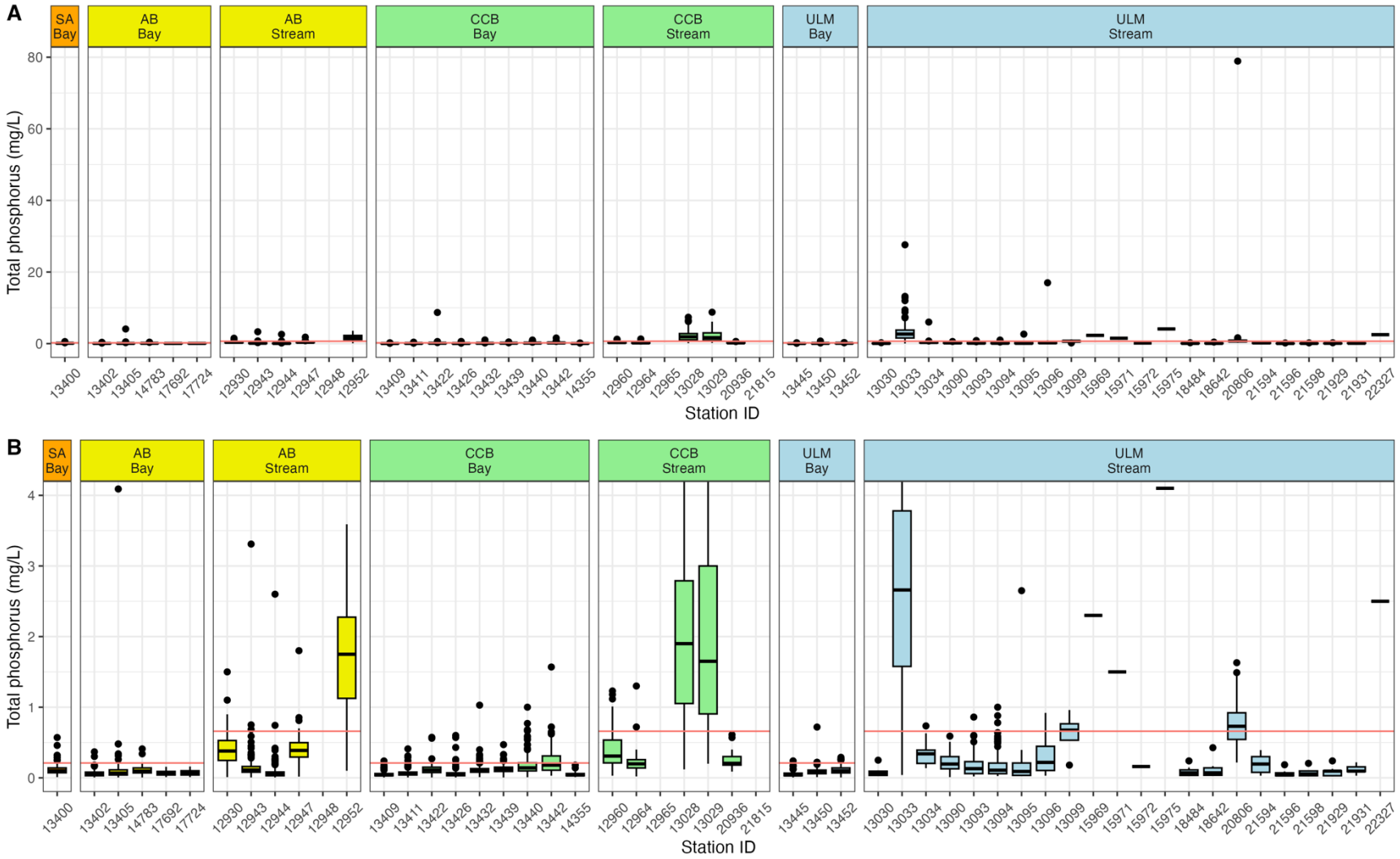

Figure D26. A) Total phosphorus levels at all stations with available data. The horizontal red line represents the TCEQ screening criteria levels for phosphorus (0.21µg/L in bay sites and 0.66µg/L in stream sites).

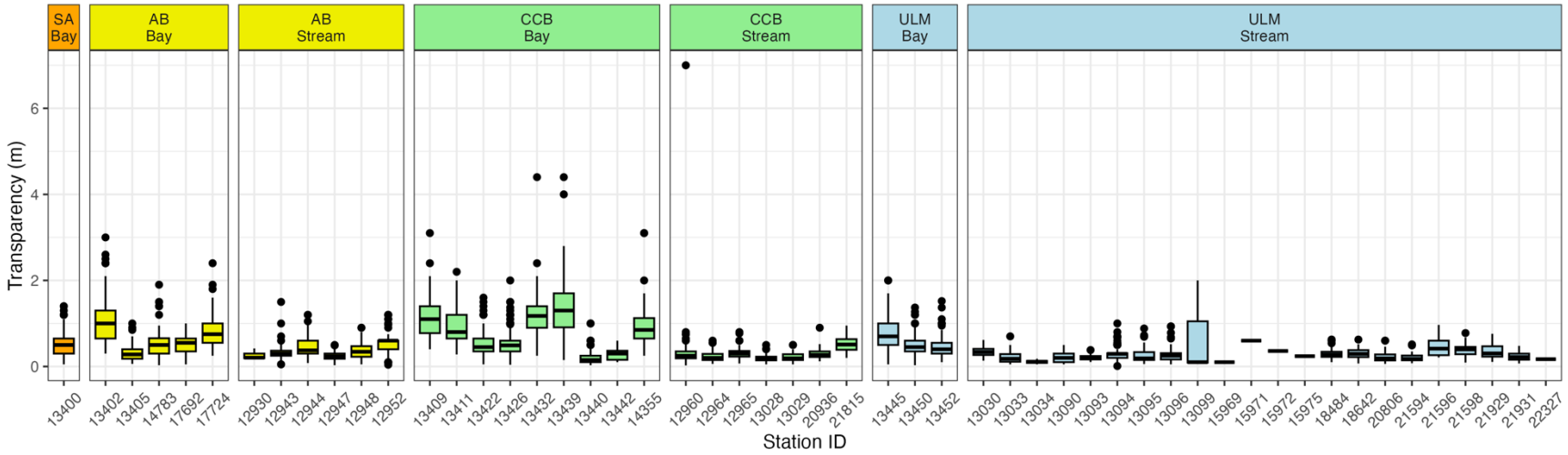

Figure D27. Transparency levels at all stations with available data.

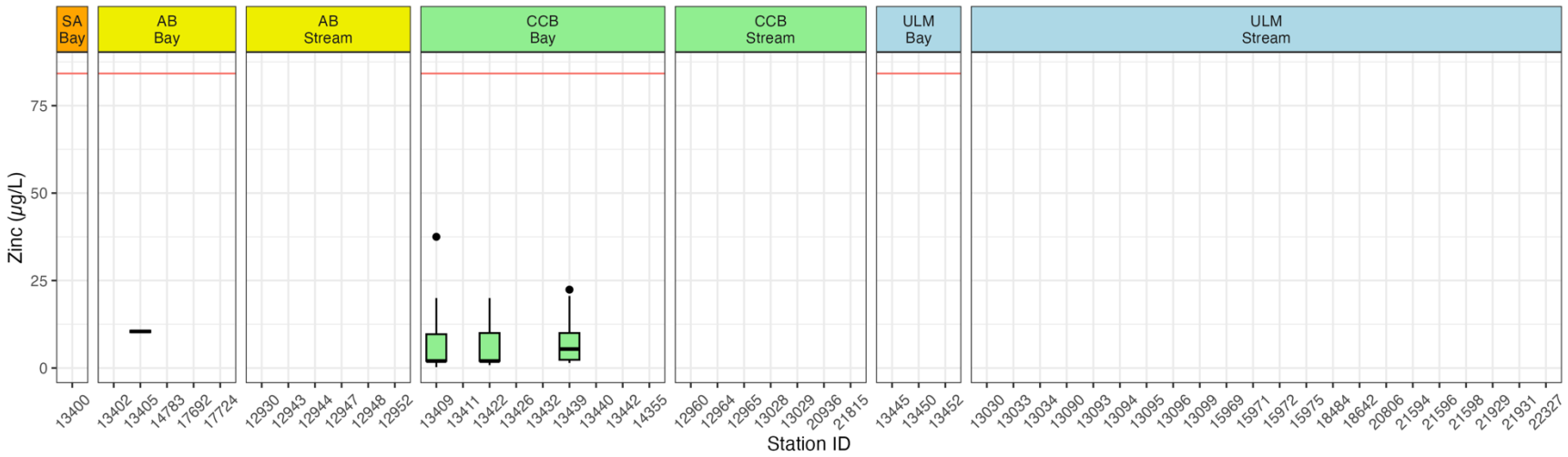

Figure D28. Zinc levels at all stations with available data. The horizontal red line represents the TCEQ screening criteria levels for zinc (84.2µg/L in bay sites). Screening criteria are not included for stream sites, as the value is dynamic and calculated based on water hardness, which was not available during this analysis.

Appendix E. Spatial interpolation maps.

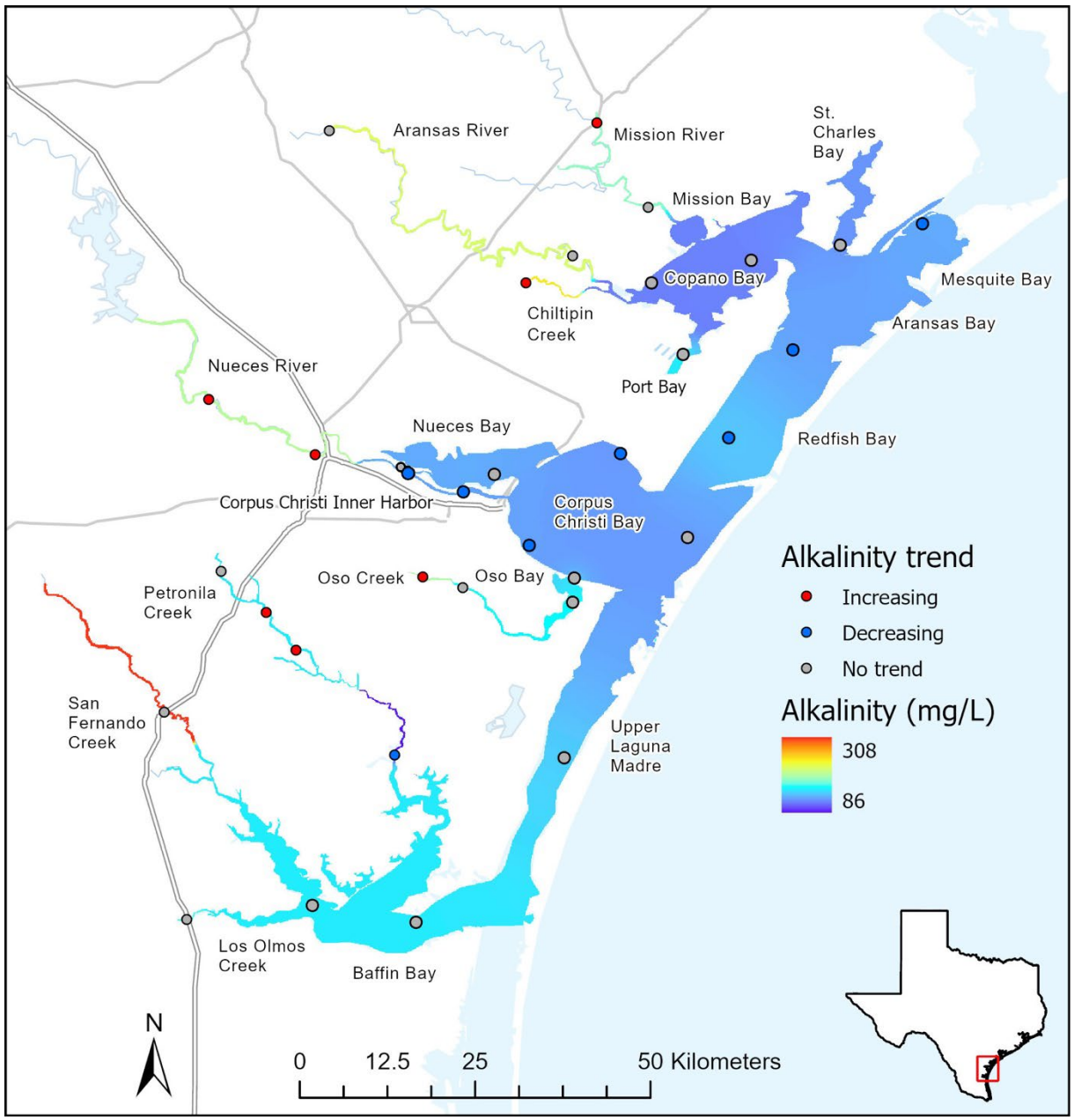

Figure E1. Map of the Coastal Bend showing the trends (10+ years) and current status (three-year geometric mean) of alkalinity.

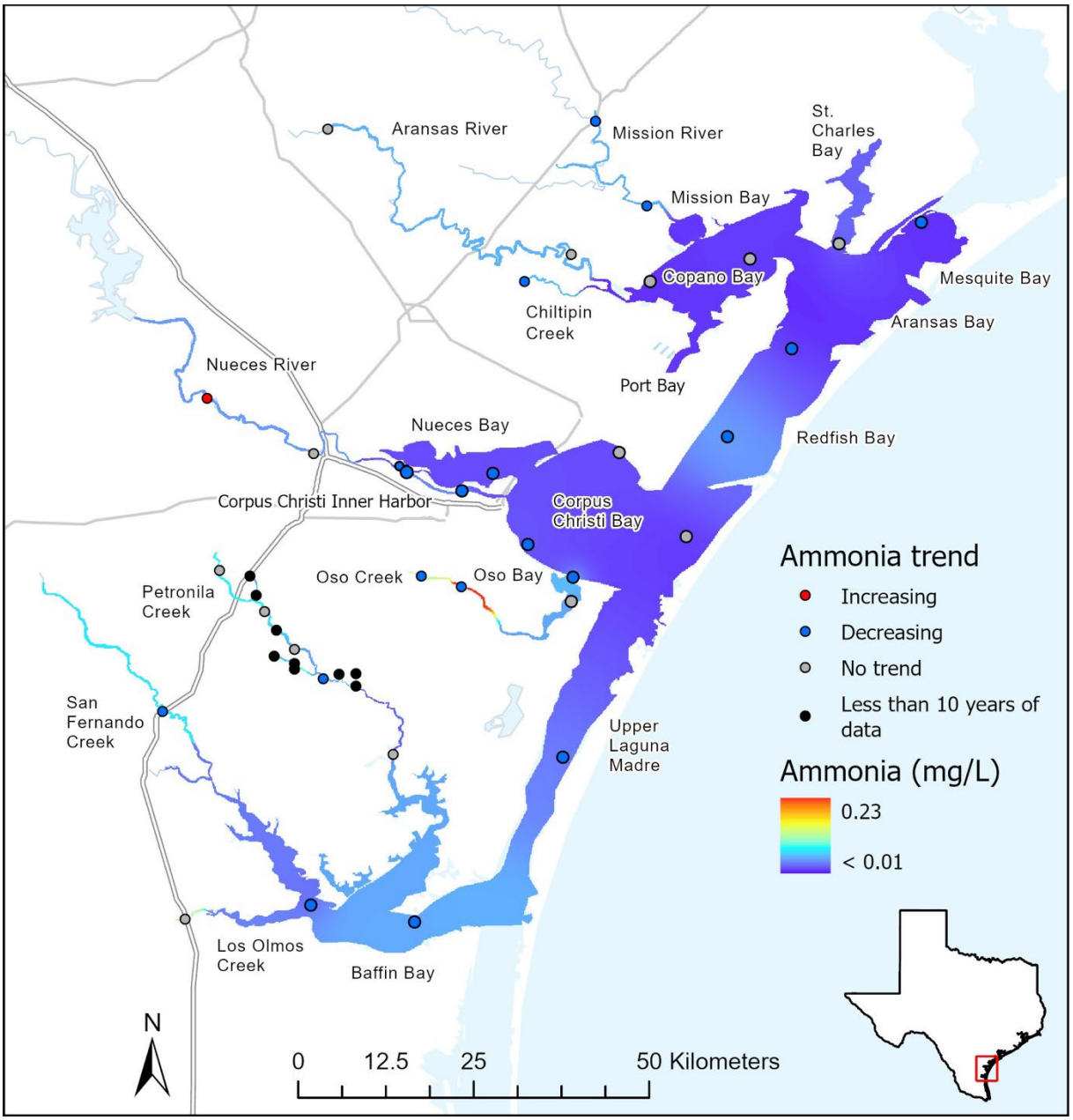

Figure E2. Map of the Coastal Bend showing the trends (10+ years) and current status (three-year geometric mean) of ammonia.

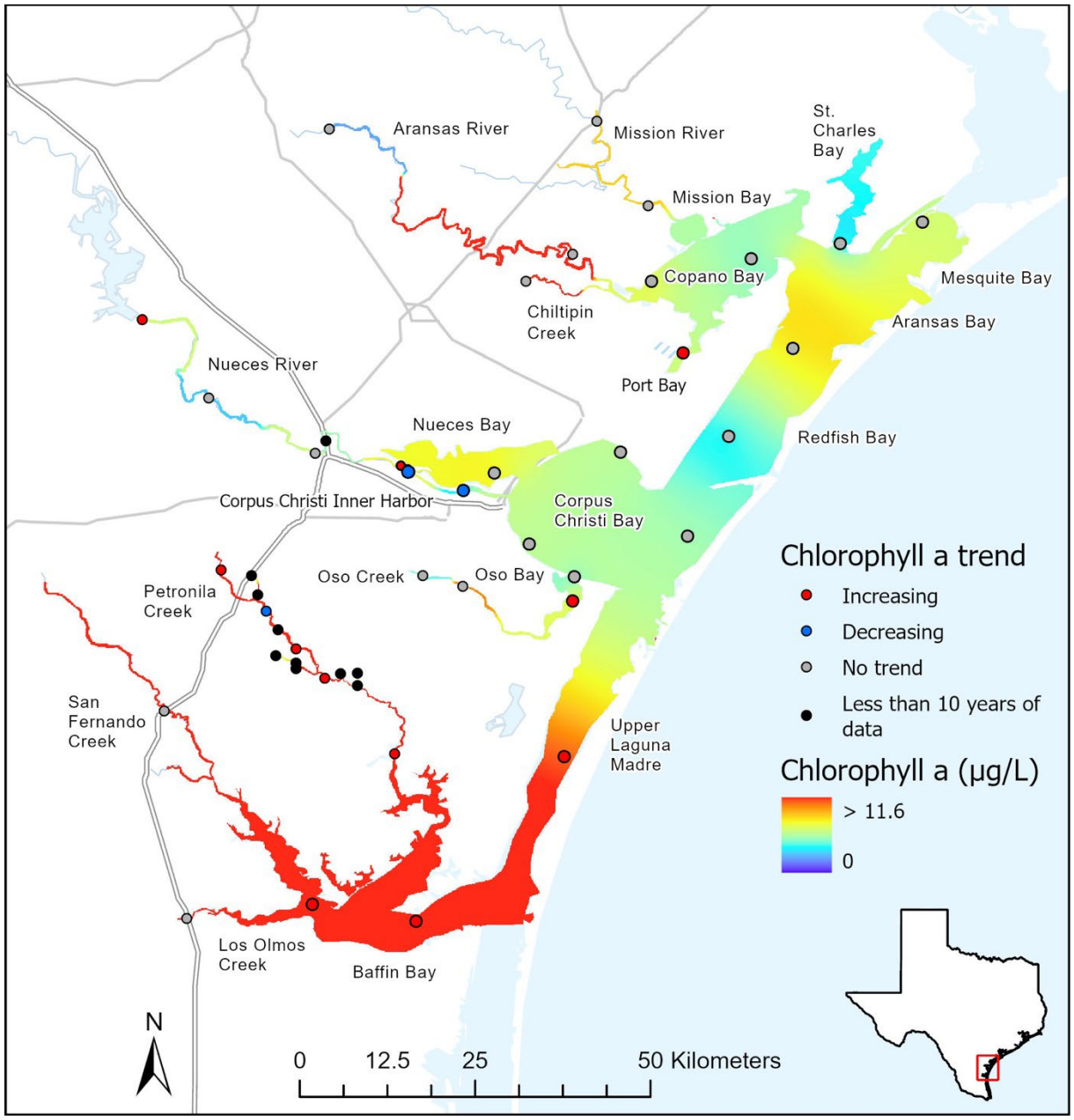

Figure E3. Map of the Coastal Bend showing the trends (10+ years) and current status (three-year geometric mean) of chlorophyll a.

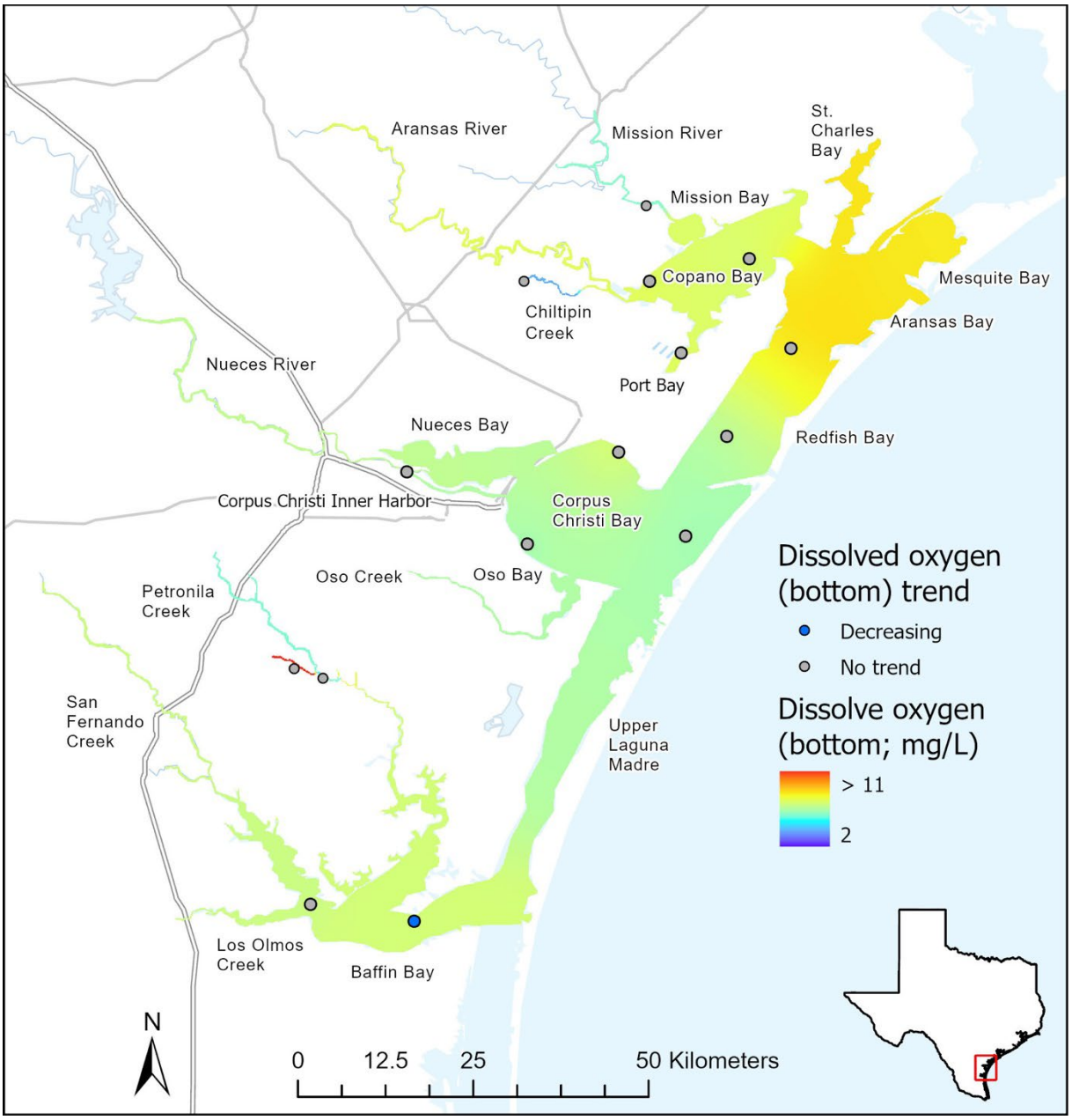

Figure E4. Map of the Coastal Bend showing the trends (10+ years) and current status (three-year geometric mean) of dissolved oxygen (bottom).

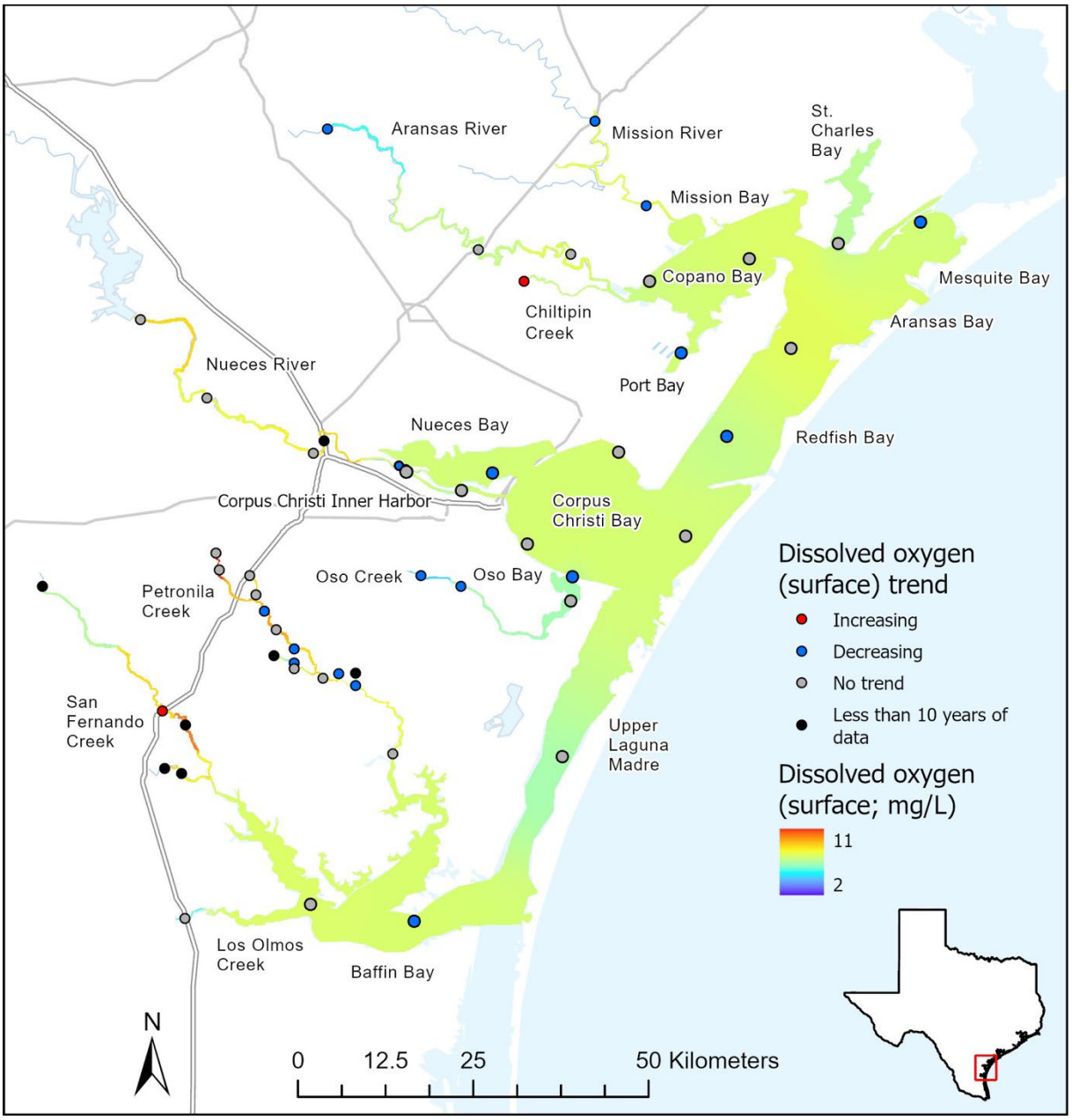

Figure E5. Map of the Coastal Bend showing the trends (10+ years) and current status (three-year geometric mean) of dissolved oxygen (surface).

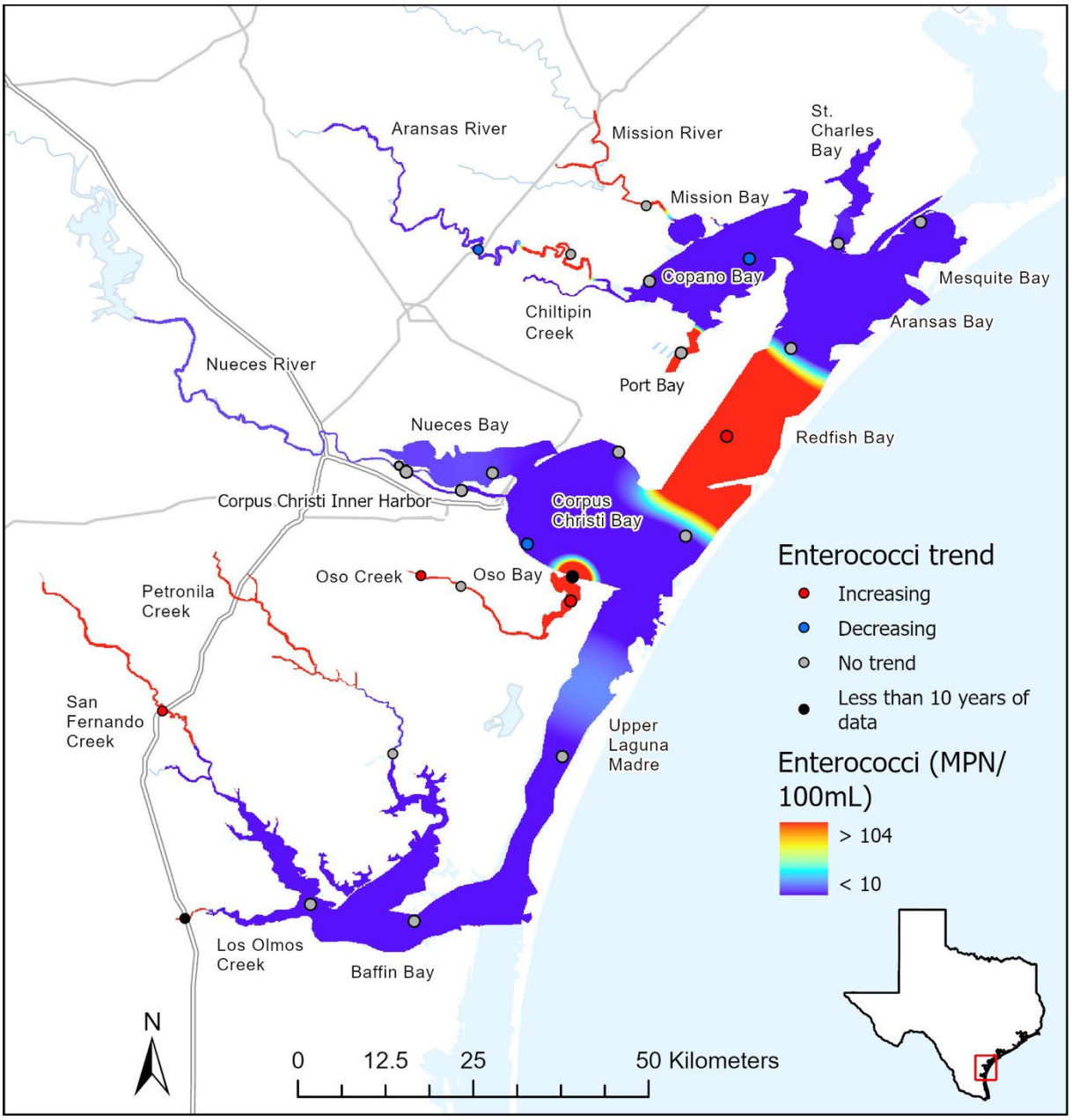

Figure E6. Map of the Coastal Bend showing the trends (10+ years) and current status (three-year geometric mean) of enterococci.

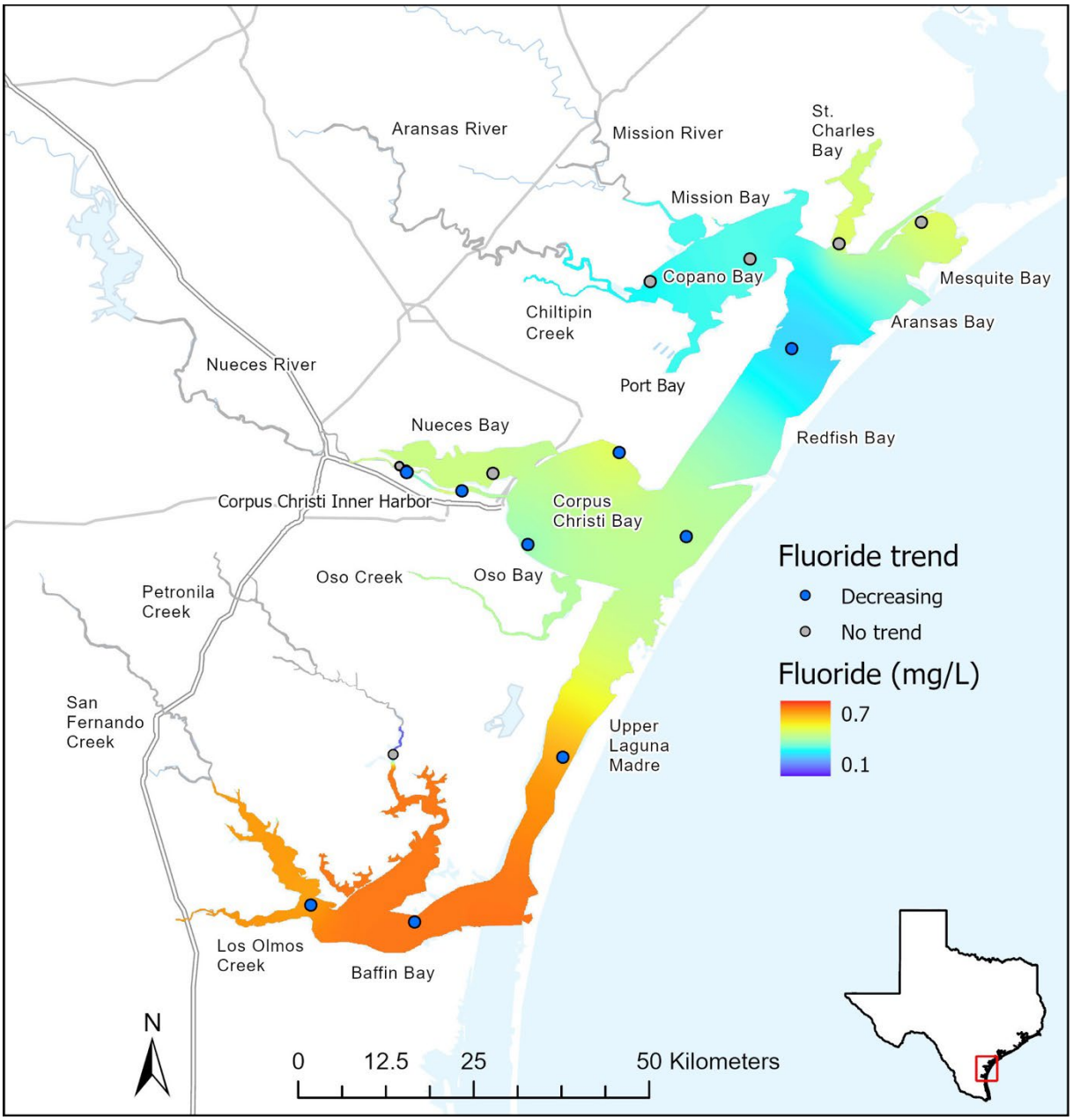

Figure E7. Map of the Coastal Bend showing the trends (10+ years) and current status (three-year geometric mean) of fluoride. Fluoride data was not available for the majority of streams (shown in gray).

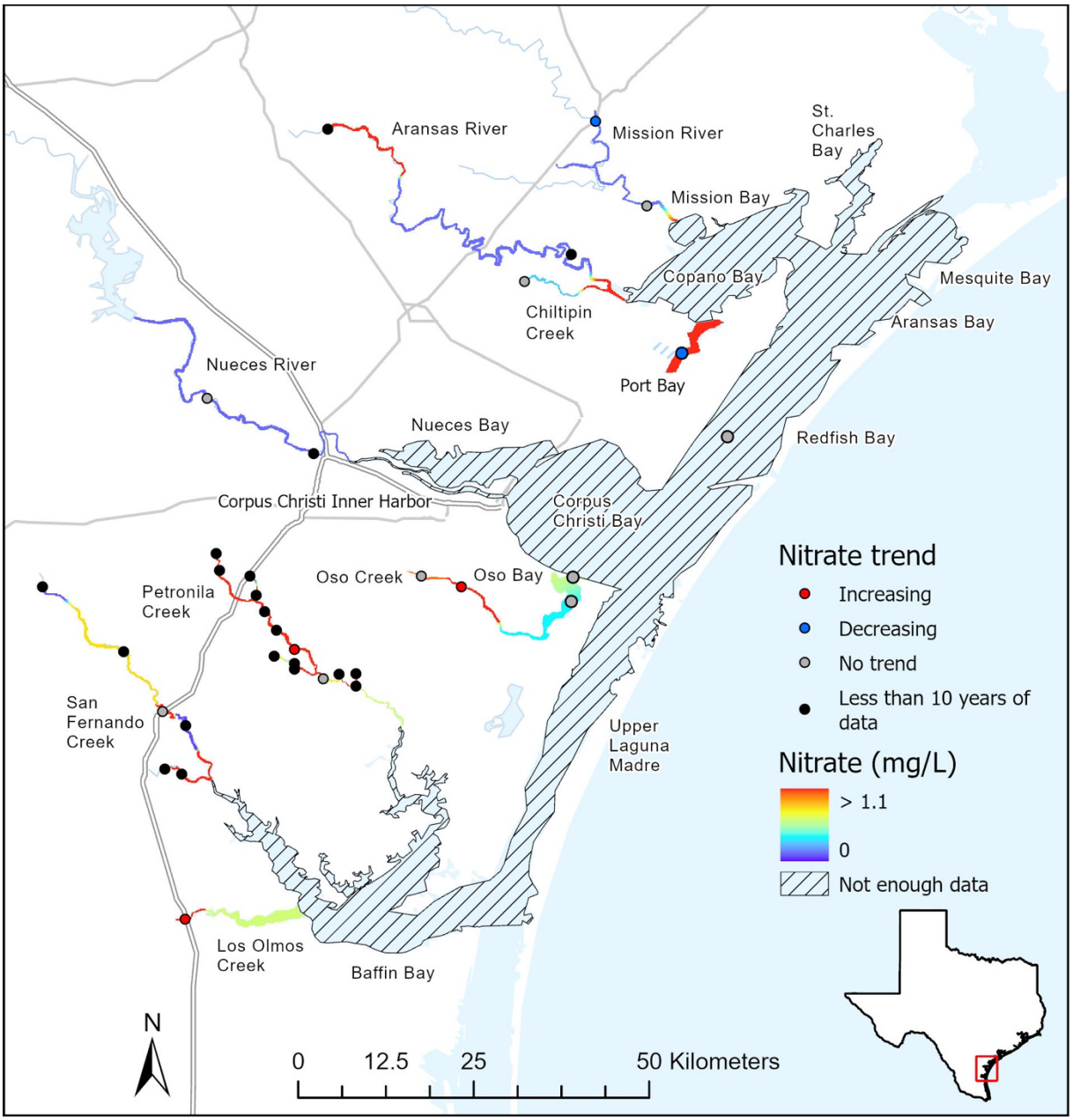

Figure E8. Map of the Coastal Bend showing the trends (10+ years) and current status (three-year geometric mean) of nitrate. Nitrate data was not available for the majority of bay sites (shown with gray diagonal lines).

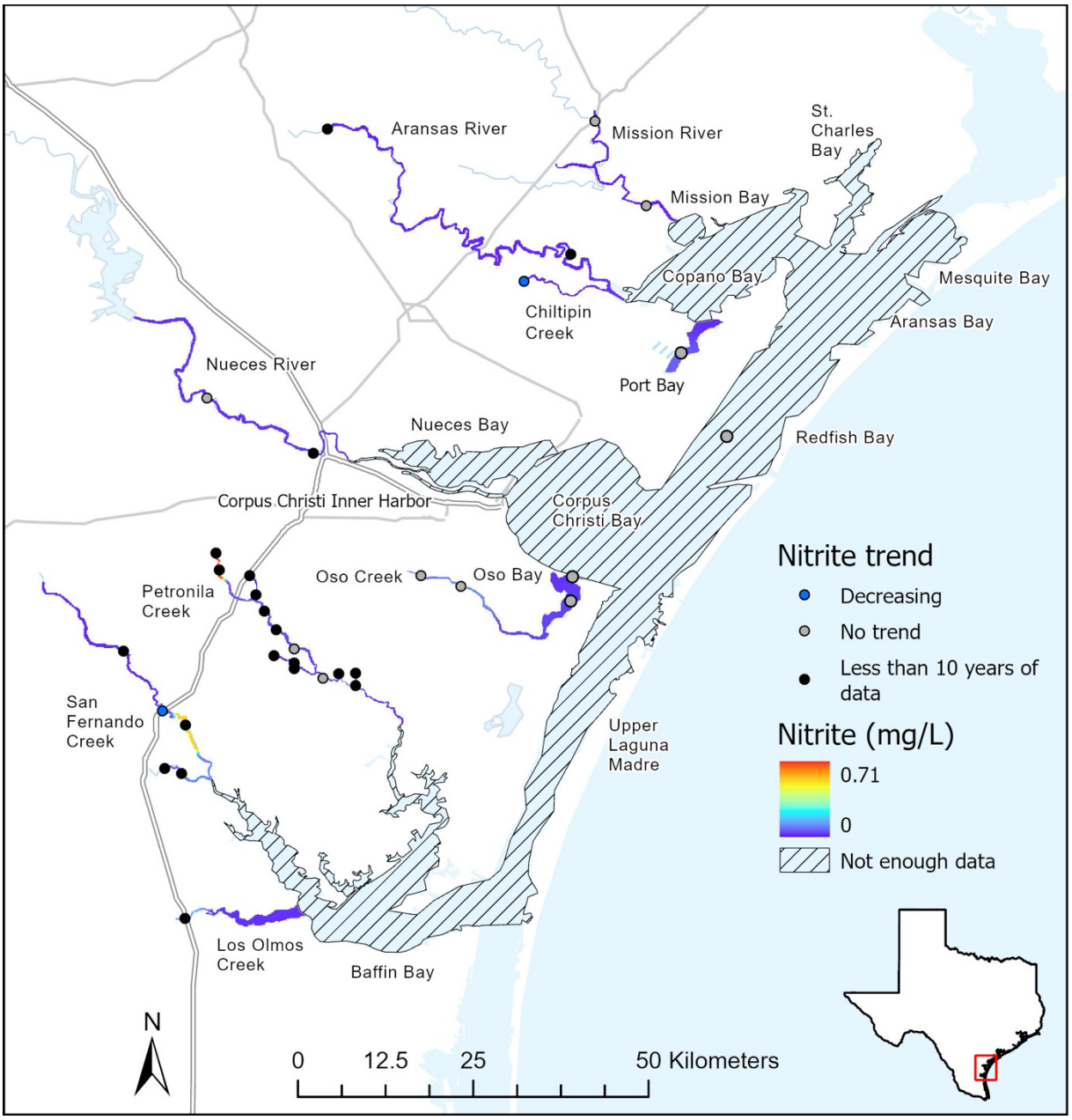

Figure E9. Map of the Coastal Bend showing the trends (10+ years) and current status (three-year geometric mean) of nitrite. Nitrite data was not available for the majority of bay sites (shown with gray diagonal lines).

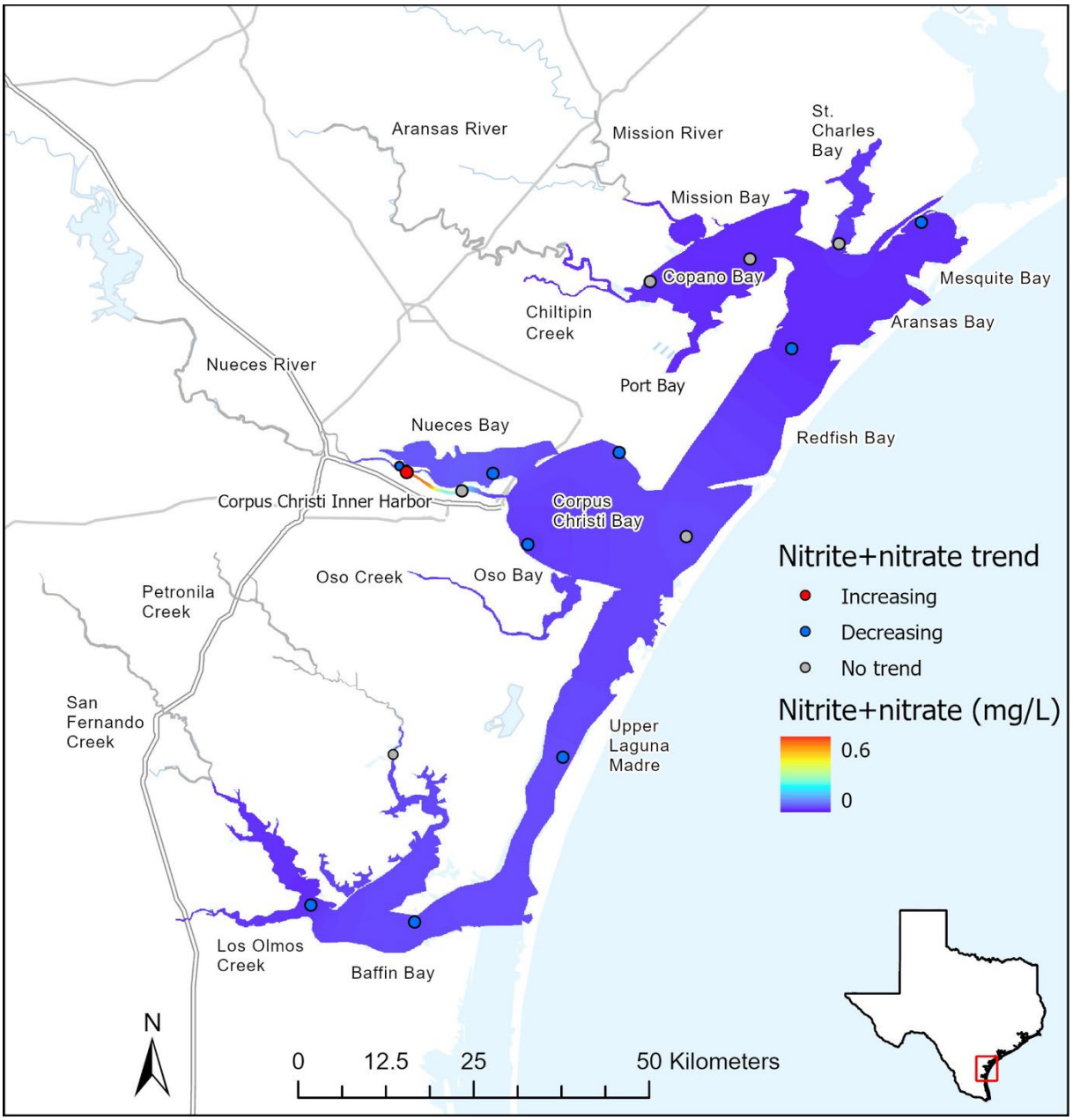

Figure E10. Map of the Coastal Bend showing the trends (10+ years) and current status (three-year geometric mean) of Nitrite+nitrate. Nitrite+nitrate data was not available for the majority of streams (shown in gray).

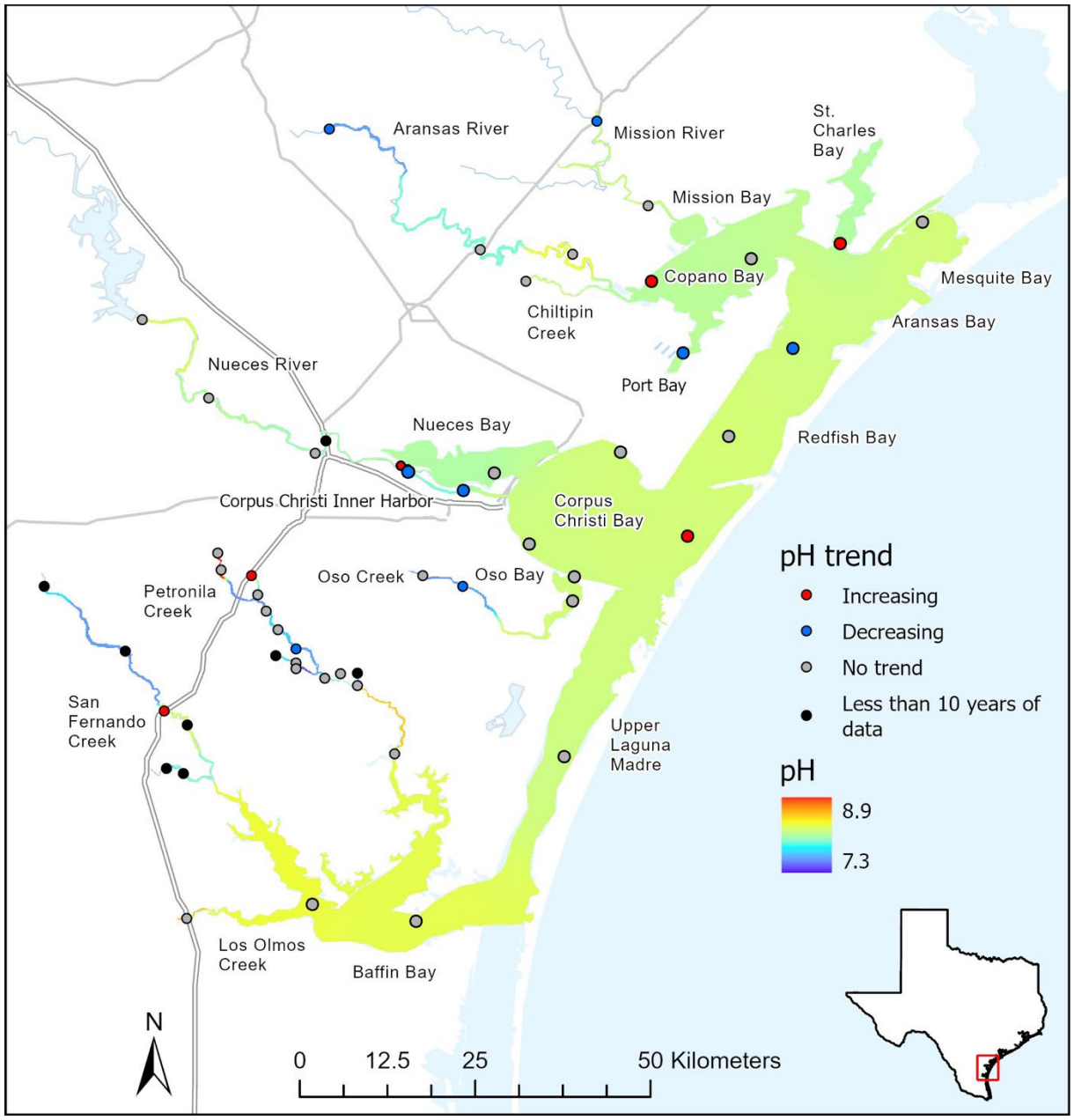

Figure E11. Map of the Coastal Bend showing the trends (10+ years) and current status (three-year geometric mean) of pH.

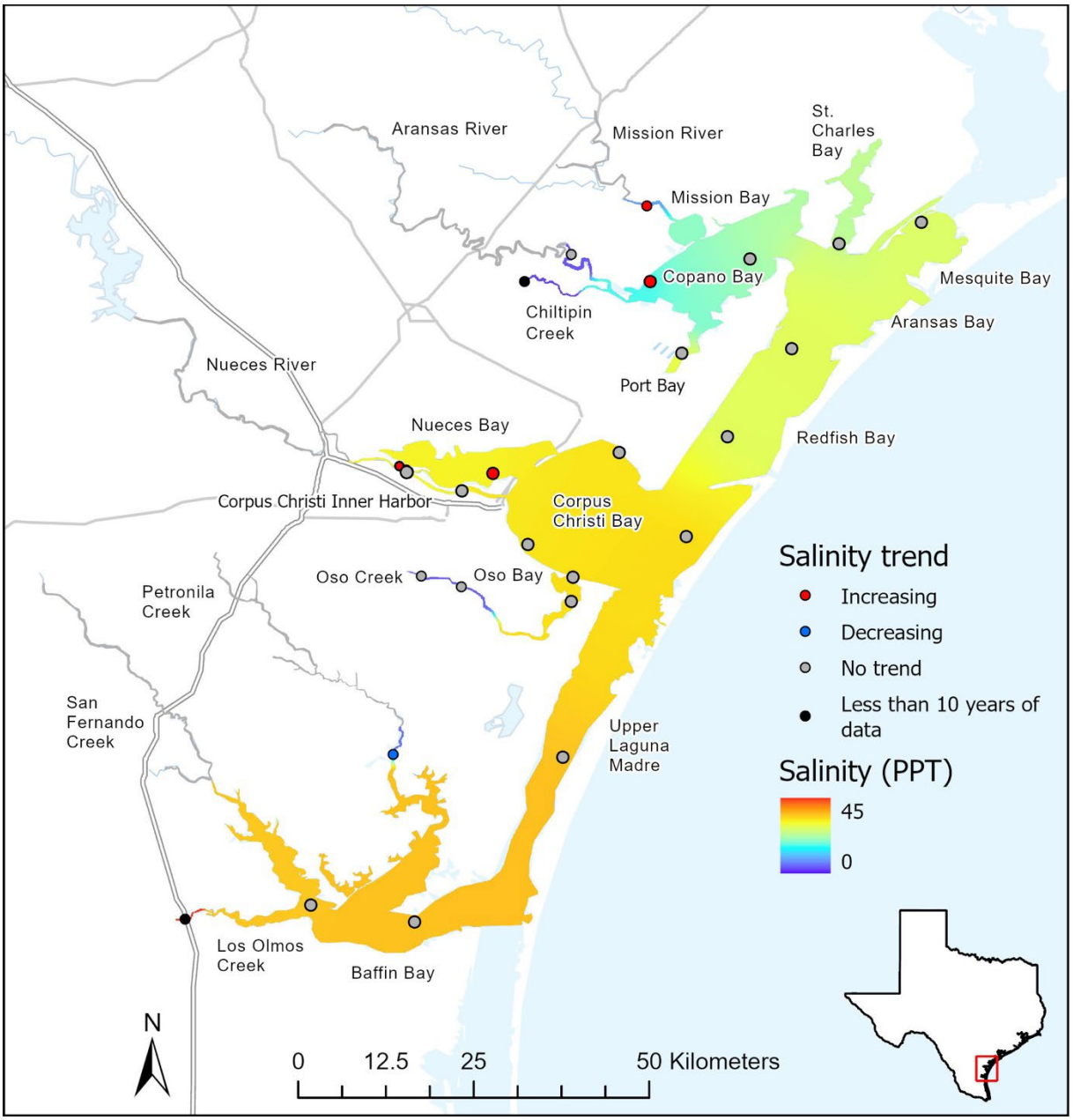

Figure E12. Map of the Coastal Bend showing the trends (10+ years) and current status (three-year geometric mean) of salinity. Salinity data was not available for the majority of streams (shown in gray).

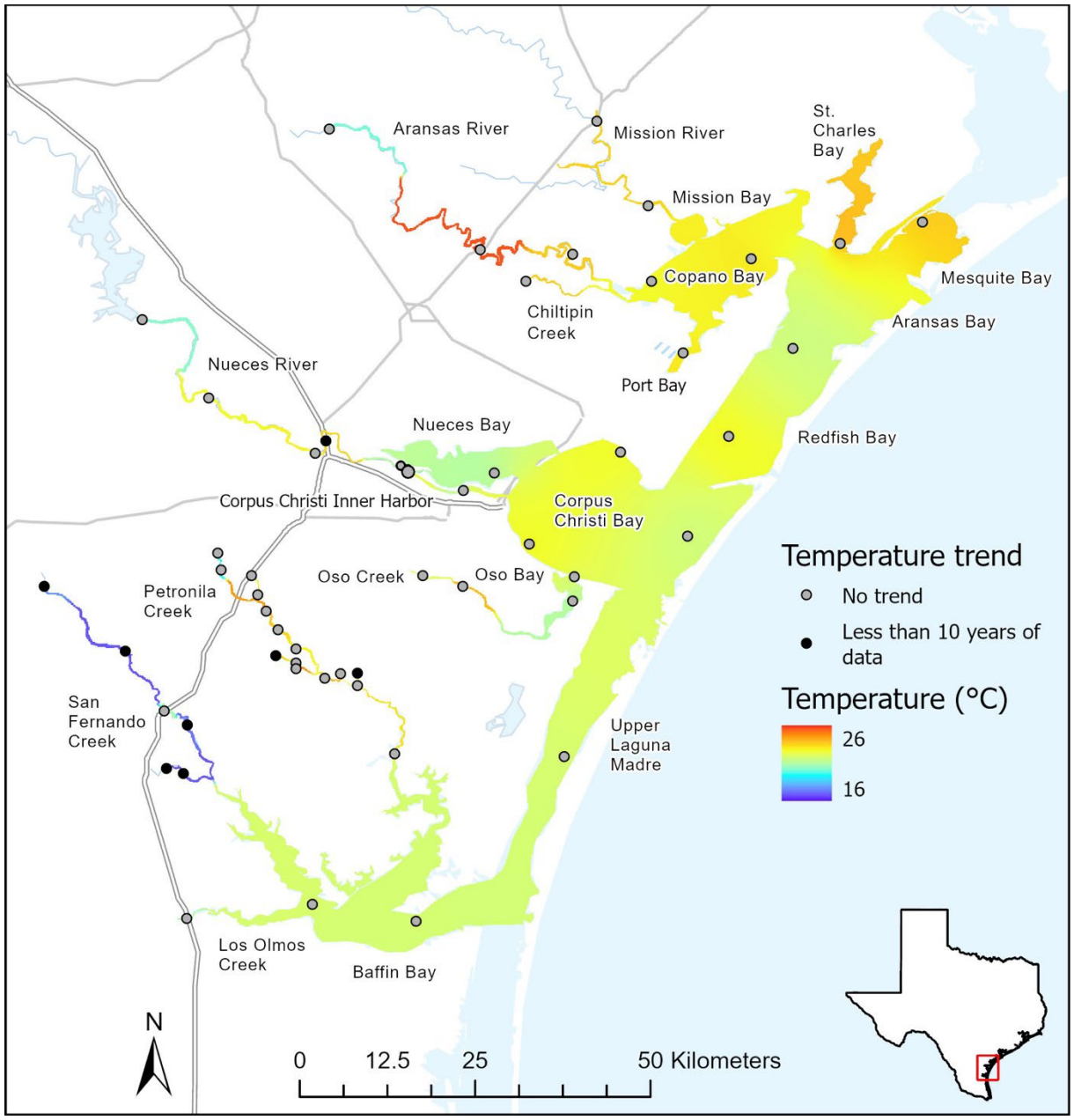

Figure E13. Map of the Coastal Bend showing the trends (10+ years) and current status (three-year geometric mean) of temperature.

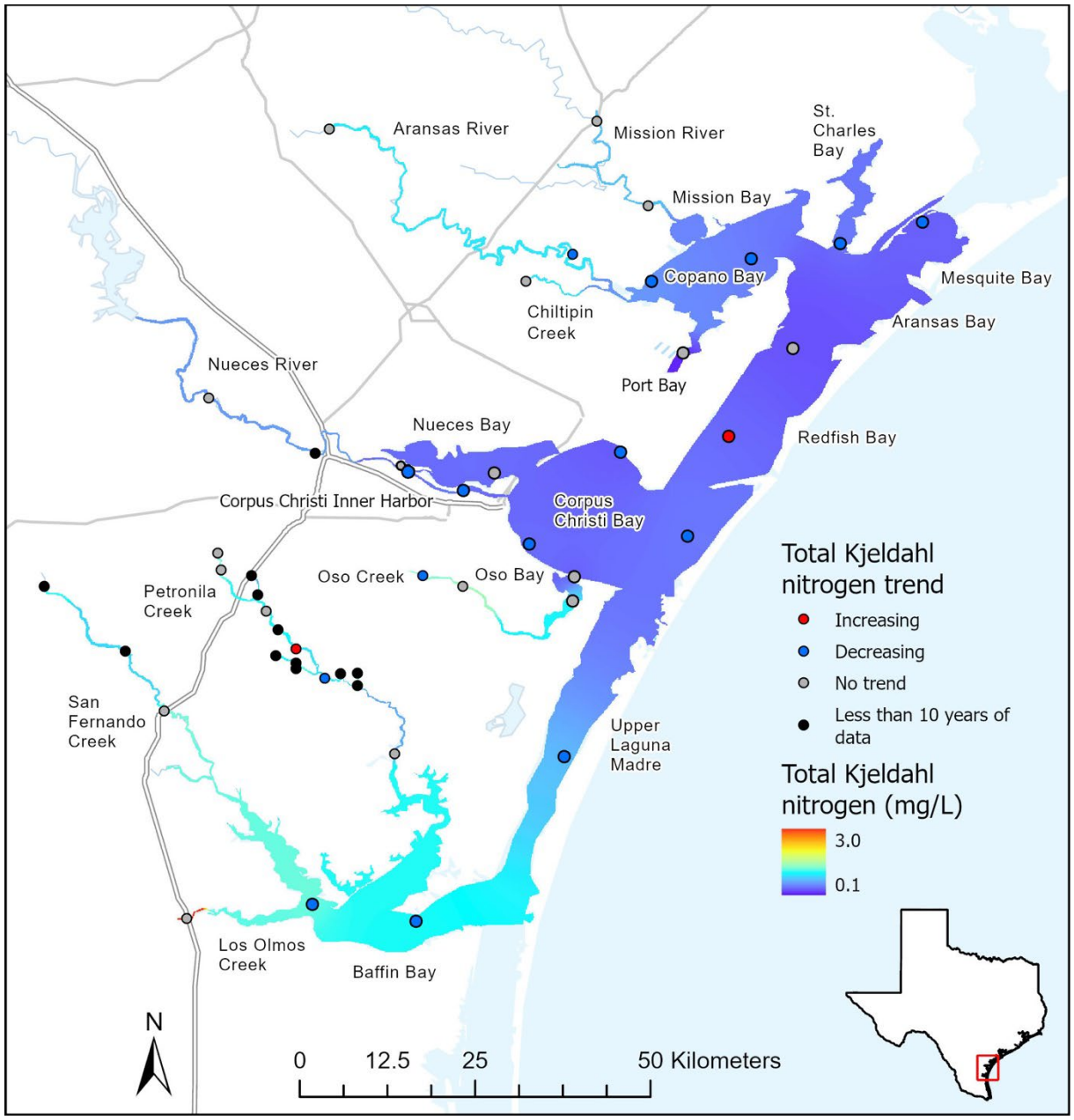

Figure E14. Map of the Coastal Bend showing the trends (10+ years) and current status (three-year geometric mean) of total Kjeldahl nitrogen.

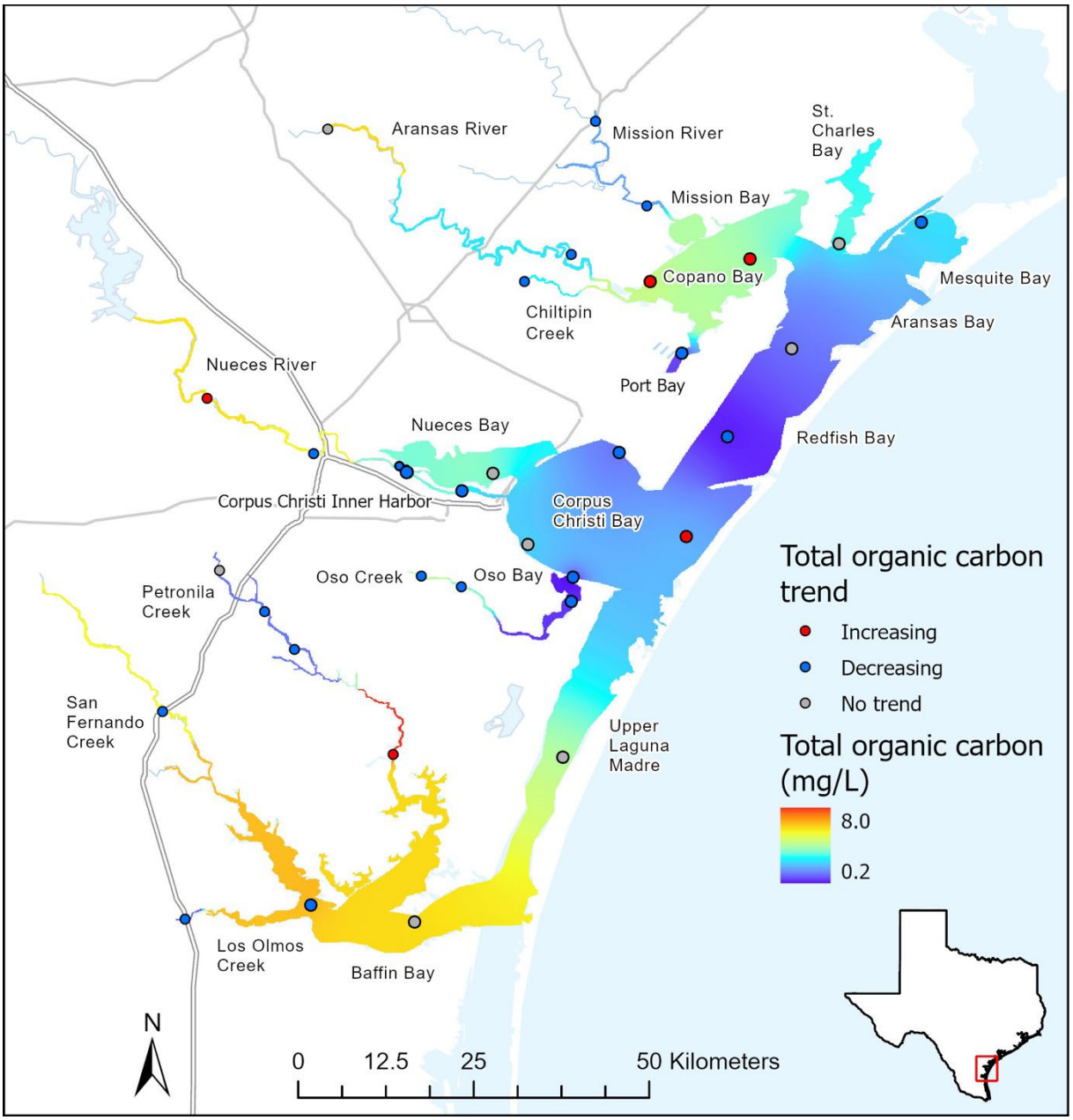

Figure E15. Map of the Coastal Bend showing the trends (10+ years) and current status (three-year geometric mean) of total organic carbon.

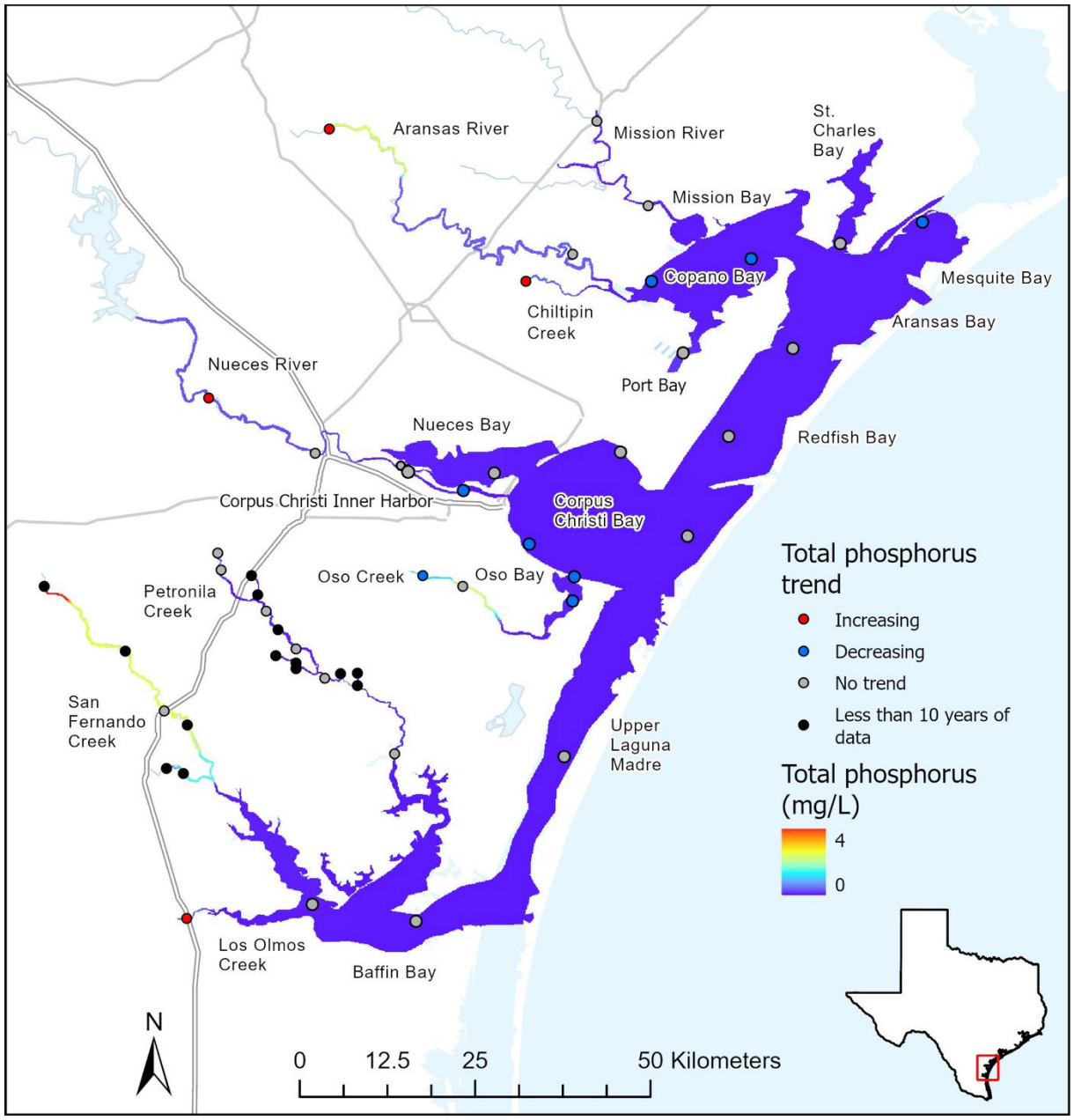

Figure E16. Map of the Coastal Bend showing the trends (10+ years) and current status (three-year geometric mean) of total phosphorus.

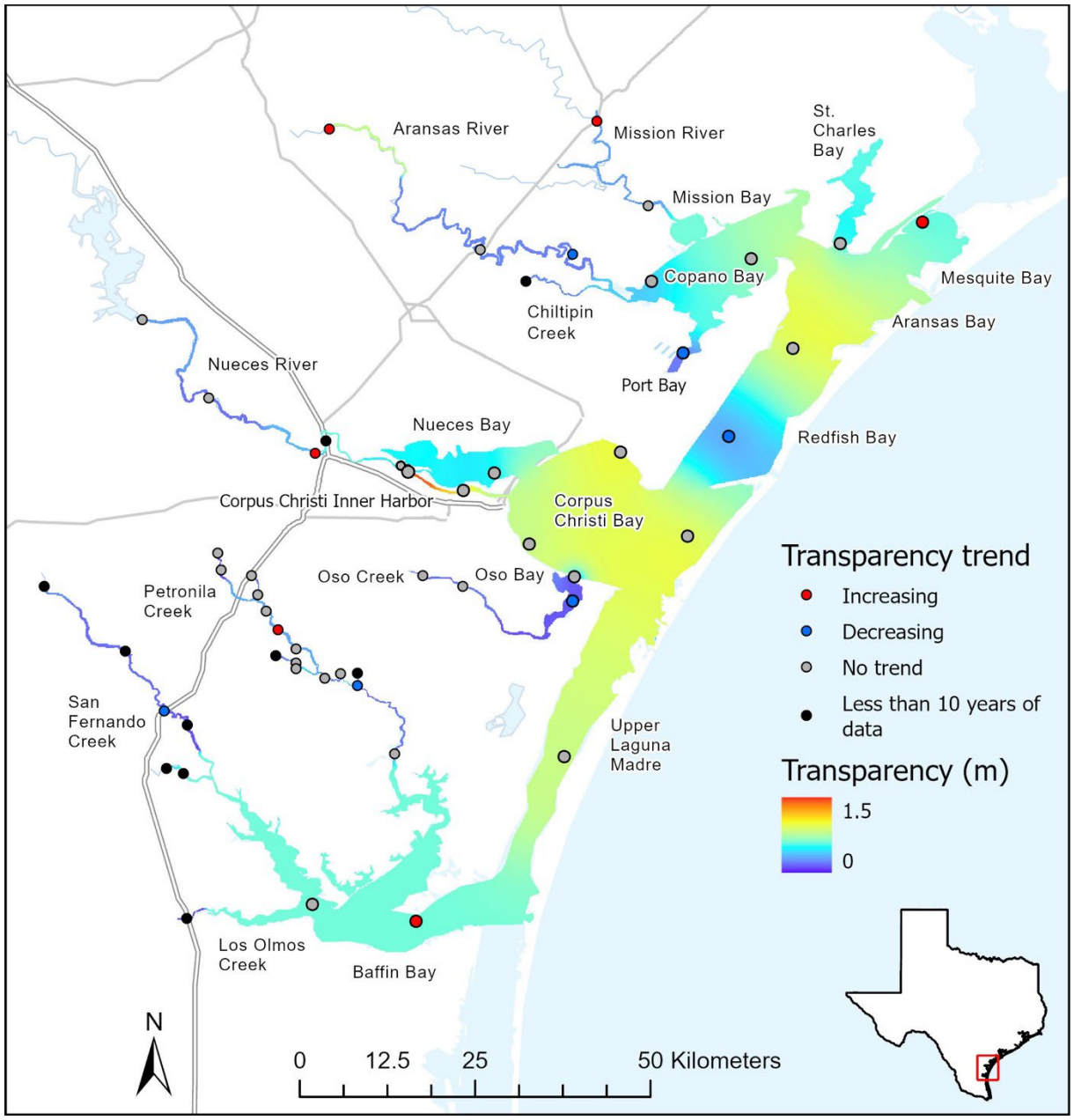

Figure E17. Map of the Coastal Bend showing the trends (10+ years) and current status (three-year geometric mean) of transparency.