STATE OF THE OCEAN SUMMARY REPORT 2022-2023

SD Public Utilities

Presented in this report is a summary of the 2022-2023 data collection efforts for the Point Loma Ocean Outfall (PLOO) and South Bay Ocean Outfall (SBOO) regions, from northern San Diego County southward across the international border into northern Baja, and extending offshore to depths of up to 500 m.

All figures presented in this summary report are for illustrative purposes only and so for more detailed information and in depth analysis please refer to the City of San Diego 2022-2023 Receiving Waters Biennial Report:

City of San Diego. (2024). Biennial Receiving Waters Monitoring and Assessment Report for the Point Loma and South Bay Ocean Outfalls, 2022–2023. City of San Diego Ocean Monitoring Program, Public Utilities Department, Environmental Monitoring and Technical Services Division, San Diego, CA.

All raw data for the 2022-2023 sampling period have been submitted to either the San Diego Regional Water Quality Control Board (SDRWQCB) or the California Environmental Data Exchange Network (CEDEN) and may also be accessed upon request to the City of San Diego.

SD Public Utilities

STATE OF THE OCEAN SUMMARY REPORT

2022-2023

Point Loma Wastewater Treatment Plant
(Order No. R9-2017-0007 (amended by R9-2022-0078); NPDES No. CA0107409)

South Bay Water Reclamation Plant
(Order No. R9-2021-0011; NPDES No. CA0109045)

South Bay International Wastewater Treatment Plant
(Order No. R9-2021-0001; NPDES No. CA0108928)

Prepared by:
City of San Diego Ocean Monitoring Program
Environmental Monitoring and Technical Services Division
Public Utilities Department

Dr. Ryan Kempster, Managing Editor

December 2024

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OVERVIEW

OVERVIEW

The City of San Diego (City) conducts an extensive Ocean Monitoring Program to evaluate potential environmental effects associated with the discharge of treated wastewater to the Pacific Ocean via the Point Loma and South Bay Ocean Outfalls (PLOO and SBOO, respectively). Data collected are used to determine compliance with receiving water quality requirements as specified in National Pollutant Discharge Elimination System (NPDES) permits, and associated orders, issued by the San Diego Regional Water Quality Control Board (SDRWQCB) and the U.S. Environmental Protection Agency (USEPA). These permits are issued to the City's Point Loma Wastewater Treatment Plant (PLWTP), South Bay Water Reclamation Plant (SBWRP), and the South Bay International Wastewater Treatment Plant (SBIWTP), which is operated by the U.S. Section of the International Boundary and Water Commission (USIBWC).

The principal objectives of the combined ocean monitoring efforts for both the PLOO and SBOO are to:

(1) Measure and document compliance with NPDES permit requirements and California Ocean Plan (Ocean Plan) water quality objectives and standards;

(2) Track movement and dispersion of the wastewater plumes discharged via the outfalls;

(3) Assess any impact of wastewater discharge on the local marine ecosystem, including effects on coastal water quality, seafloor sediments, and marine life.

Coulson Lantz collecting a water sample.

Adriano Feit inspecting the trawl net after pulling up a large catch

OCEAN CONDITIONS

OCEAN CONDITIONS

Oceanographic conditions during the 2022-2023 monitoring period, such as water temperature, salinity, dissolved oxygen (DO) concentrations, pH, natural light level (transmissivity or water clarity), and concentration of chlorophyll *a* were generally within historical ranges and followed typical seasonal patterns reported for the PLOO and SBOO monitoring regions.

As is characteristic for these waters, ocean conditions indicative of local coastal upwelling, such as relatively cold, dense waters with low DO and pH at subsurface depths, were most evident during the spring months of both years and winter months of 2023. These observations suggest that overall, the temporal and spatial variability observed in oceanographic conditions for coastal San Diego can be explained by a combination of local (e.g., coastal upwelling, rain-related runoff) and large-scale oceanographic-climatic processes, notably the transition from La Niña to El Niño conditions in late 2023, which allowed for the intrusion of warm water masses from offshore heatwave events once La Niña conditions broke down.

Overall, ocean conditions during 2022 and 2023 were consistent with well documented patterns for southern California and northern Baja California. These findings suggest that natural factors, such as upwelling of deep ocean waters, and changes due to climatic events, such as El Niño/La Niña oscillations, continue to explain most of the temporal and spatial variability observed in the coastal waters off San Diego. As a result, proximity to either outfall is not considered a significant driver of the variations observed in oceanographic parameters.

Ocean conditions were consistent with well documented patterns for southern California and northern Baja California, suggesting that natural factors, such as upwelling of deep ocean waters, continue to explain most of the variability observed in the coastal waters off San Diego.

Scripps Institution of Oceanography researchers joined City Staff to assist in the deployment of our Real-Time Oceanographic Mooring System (RTOMS).

Greg Welch inspecting ocean sensors and cables before deployment.

WATER QUALITY

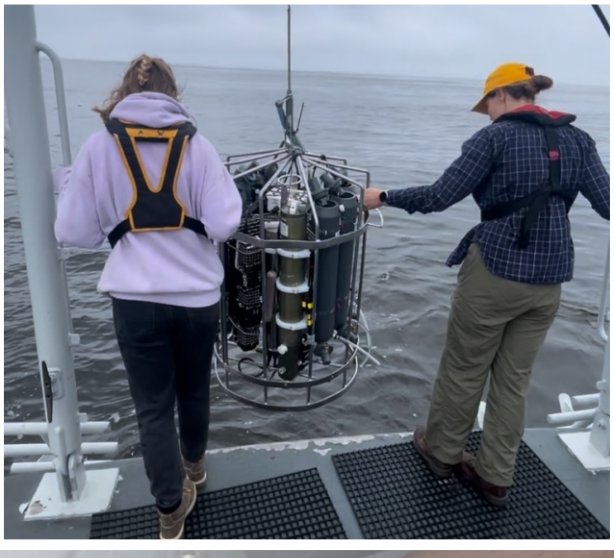
WATER QUALITY

Overall water quality compliance during 2022–2023 was higher in the PLOO region than the SBOO region, and better at offshore stations (>9m depth) compared to shore stations (<9m depth), as has been observed in the past.

Throughout the PLOO region, overall compliance with the 2019 Ocean Plan water contact standards was above the minimum threshold for all metrics throughout the report period. In contrast, in the SBOO region, overall compliance was below the minimum threshold for all metrics except for offshore stations.

Shore stations located near the mouth of the Tijuana River and in Mexican waters near San Antonio de Los Buenos Creek historically had higher numbers of elevated fecal indicator bacteria (FIB) samples than stations located farther to the north. Satellite imagery confirmed that sewage-laden discharges from the Tijuana River and San Antonio de Los Buenos Creek were likely sources of bacteria during or after storms or other periods of increased flows. The spatial and temporal distribution of elevated FIB observed during the current report period corroborate the findings of previous City reports and other studies, which suggested that the Tijuana River and other terrestrial inputs were the largest drivers of contamination in the South Bay region.

Reduced water quality was typically observed at shore stations, particularly in the South Bay, and tended to occur more frequently during the wet season.

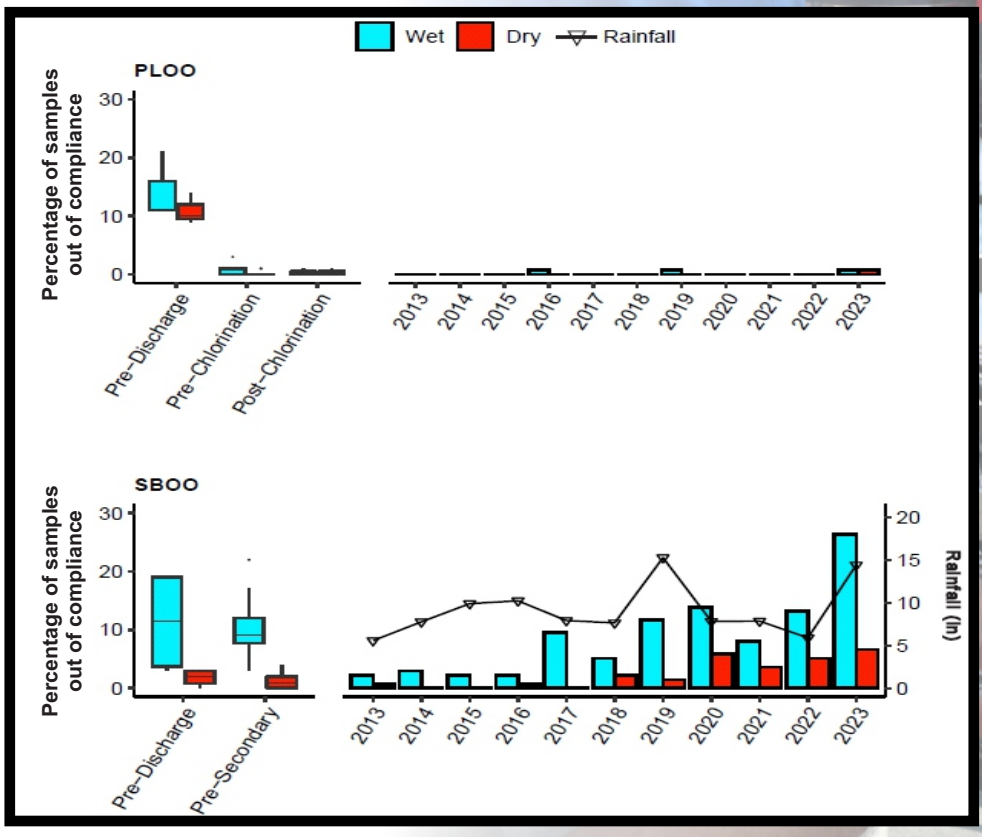


City interns being trained in the deployment of water quality sampling equipment.

Coulson Lantz operating the winch to deploy the City's water quality sampling equipment.

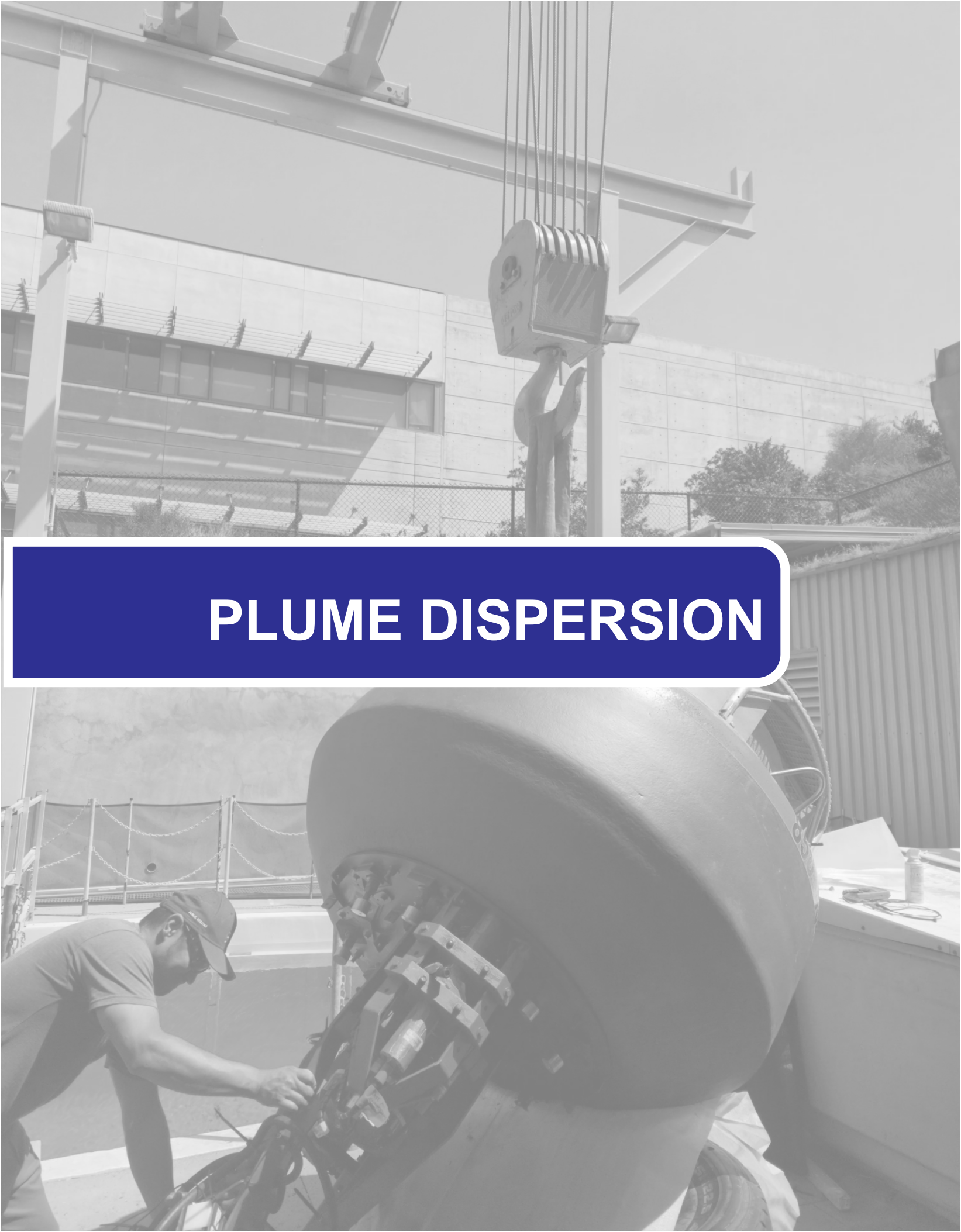
WATER QUALITY

Precipitation, which is known to drive declines in water quality, especially at shore and kelp stations, was notably higher during the current report period compared to the previous report period (20.33 inches over 2022–2023 vs. 15.68 inches over 2020–2021). Additionally, since August 2022 the SBIWTP has increased flows to the SBOO (avg. 21 MGD to 31 MGD), and since March 2023 secondary treatment has been limited, which has likely contributed to the observed decrease in water quality at offshore stations in the SBOO region compared to recent years. Nevertheless, the occurrence of samples with elevated bacterial levels near the outfall remain low compared to those taken before the initiation of secondary treatment, which began in January 2011 at the SBIWTP. The majority of analyses showing elevated bacterial levels continue to be associated with stations near the mouth of the Tijuana River Estuary and they continue to be more prevalent in the wet season. However, even in the dry season, the SBOO region exhibits a much higher number of sample exceedances than those in the PLOO region, which is likely driven by the shallow southern swell bringing surface currents northward along the coast in the summertime and thereby transporting transboundary flows of contaminated water into the South Bay. Thus, the primary source of contamination in San Diego coastal receiving waters is of known origin and likely associated with contaminated outflows from the Tijuana River and transboundary flows not related to wastewater discharge. The relatively low number of samples with elevated FIB near the outfalls, compared to the nearshore, highlight the minimal impact of treated wastewater discharge. As a result, we conclude that non-compliance with receiving water limitations for bacterial characteristics is primarily driven by known contaminated outflows from rivers, such as the Tijuana River Estuary, and other nonpoint source runoff.



Comparison of annual rainfall with occurrence of elevated Fecal Indicator Bacteria (FIB) in wet (blue bars) versus dry (red bars) seasons in PLOO and SBOO regions.

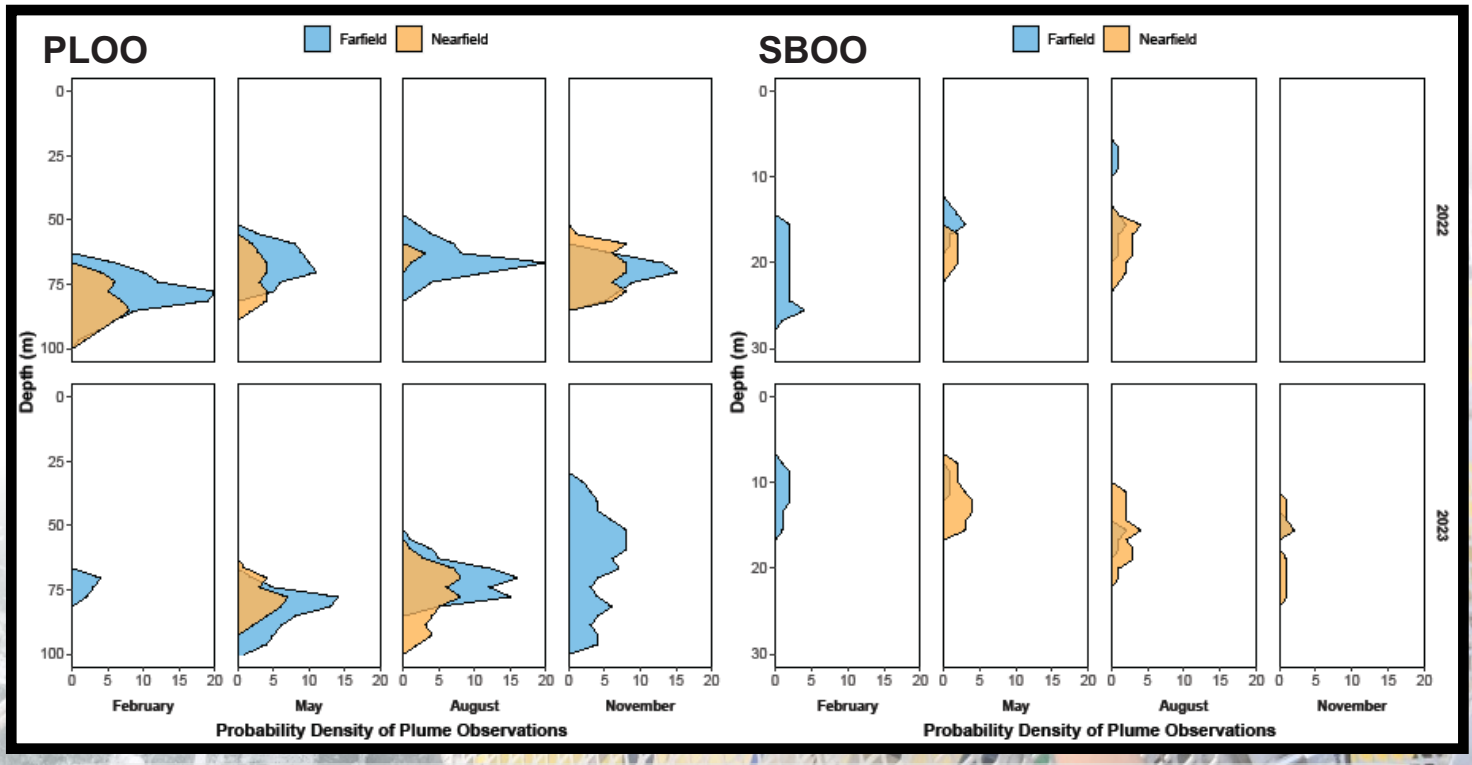
The primary source of contamination in San Diego coastal receiving waters is of known origin and likely associated with contaminated outflows from the Tijuana River and transboundary flows not related to wastewater discharge.



PLUME DISPERSION

PLUME DISPERSION

Observations of potential plume detections throughout the 2022–2023 reporting period demonstrated that the PLOO effluent plume generally remained offshore and below a depth of 34 m, while the SBOO plume was generally shallower but trapped below the pycnocline (typically >5m) during seasonal periods of water column stratification. However, unlike the PLOO plume, the SBOO plume showed evidence of rising to the surface when waters became more mixed and stratification broke down, typically during the winter months.



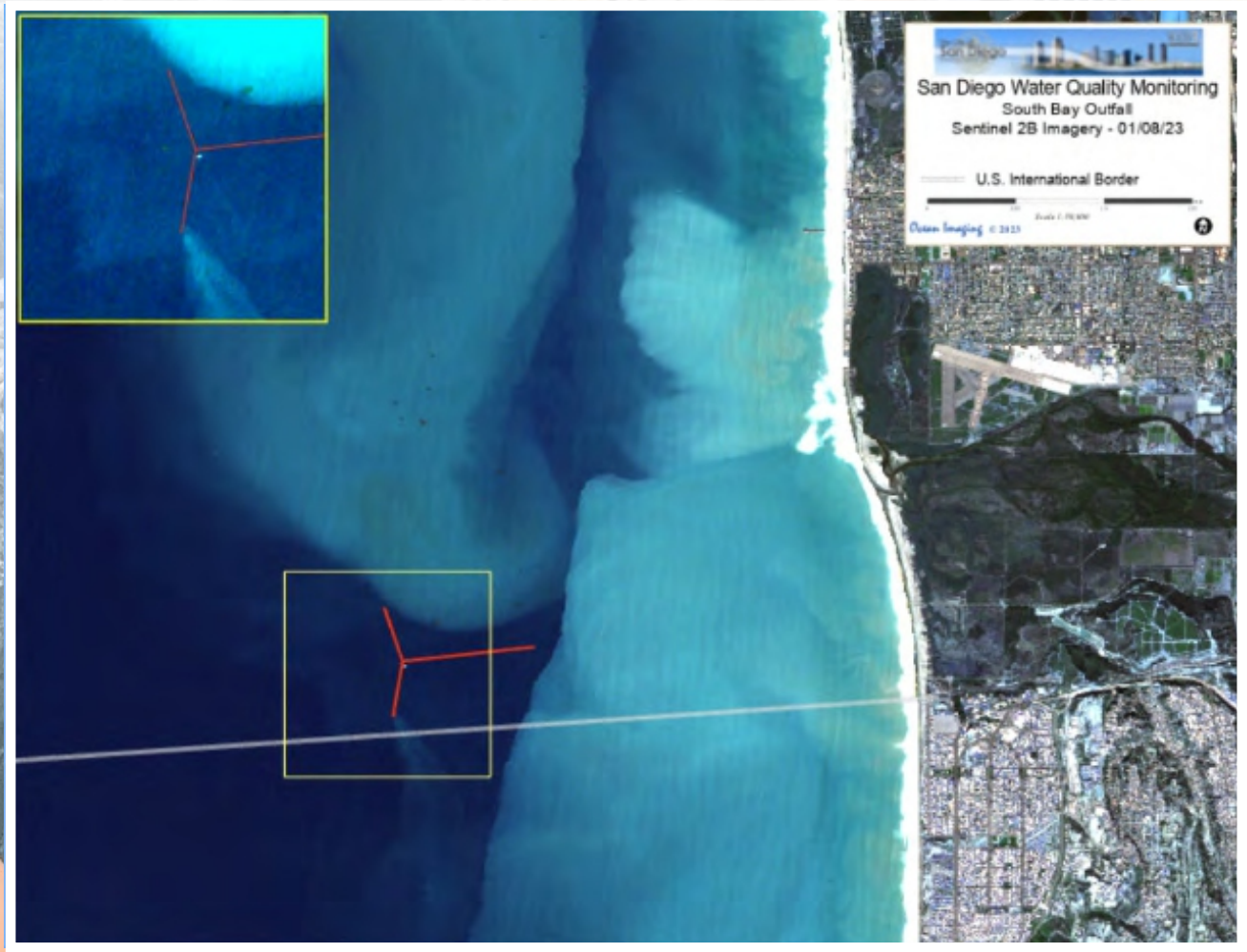
Depth profiles by season of potential wastewater plume detections at PLOO and SBOO offshore stations separated out by nearfield and farfield station locations (i.e. close and far from the outfalls).

Despite differences in observed plume vertical rise heights between the outfalls, both effluent plumes generally remained offshore and were transported along the coast with no evidence of nearshore movement. Although variable over space and time, the general axes of current velocities in the PLOO and SBOO regions followed a N:NW or S:SE trajectory. In 2023, there were several eastward excursions of surface currents during stratified conditions; however, these depths were above the pycnocline and unlikely to impact plume dispersion. Thus, as effluent mixes with ambient seawater, it generally traveled along the coast rather than being directed inshore toward the kelp beds, shoreline, or other recreational waters. As a result, there was no evidence that wastewater discharged to the ocean, via either the PLOO or SBOO, reached recreational waters along the shore or nearshore kelp beds.

PLUME DISPERSION

Results of water quality monitoring over the past 33 years off Point Loma, and 29 years in the South Bay, are consistent with observations from remote sensing studies (i.e., satellite imagery) over the last 20+ years, which show a lack of shoreward transport of wastewater plumes from either outfall.

Within the shallower SBOO region, though bacteriological analyses from monitoring stations near the outfall do indicate a slight decrease in offshore water quality during the reporting period, the Tijuana River and Los Buenos Creek remain likely sources of contaminated water during or after storms or other periods of increased flows. The Tijuana River estuary often delivers less saline, dissolved organic matter and nutrient-rich water masses, resulting in a complex environment in the SBOO region. This is consistent with past studies, which indicate that other sources, such as terrestrial runoff or outflows from rivers and creeks were more likely to impact coastal water quality than wastewater discharge from the outfalls, especially during and immediately after significant rain events.



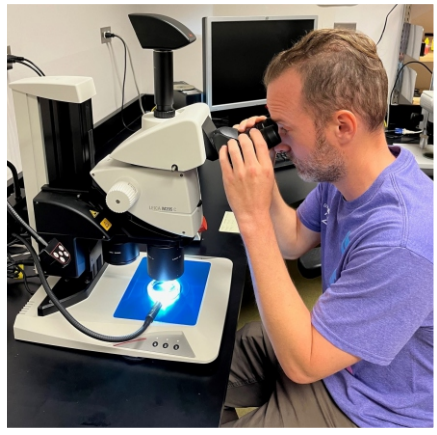
Satellite image over the SBOO showing the southward direction of the wastewater plume while the region is almost engulfed by river plumes emanating from the Tijuana River and Los Buenos Creek.

BENTHIC CONDITIONS

BENTHIC CONDITIONS

Benthic habitats, and associated biological communities, found on the continental shelf and upper slope off San Diego were found to be in good condition. The results of comprehensive assessments of benthic conditions at 89 different monitoring sites show that the physical composition of the sediments, sediment quality, and the ecological status of the resident macrofaunal communities remain stable, with little evidence of environmental impact. Particle size composition varied throughout the region, but generally followed the typical pattern of sediments becoming finer with increasing depth.

Sediment quality was excellent throughout the entire San Diego region in summer 2022–2023. There was no evidence of degraded benthic habitats, in terms of the chemical properties of the sediments, or spatial patterns in the distribution of the different types of contaminants. Although, a number of indicators of organic loading, trace metals, pesticides, and PCBs, PAHs, and PBDEs were detected in sediment samples throughout the San Diego region, almost all occurred at concentrations below critical thresholds, similar to that observed in previous years. Furthermore, examination of spatial patterns revealed no evidence of sediment contamination that could be attributed to local wastewater discharges via the PLOO or SBOO. This is further supported by results from sediment toxicity sampling, which revealed minimal toxicity at any of the near-outfall or regional stations tested, and these results, when integrated with benthic infauna and sediment chemistry results, demonstrated that the shelf off San Diego remains unimpacted by the PLOO or SBOO.



Adam Webb conducting taxonomic identifications in the lab.

Tiny hermit crab being identified under the microscope

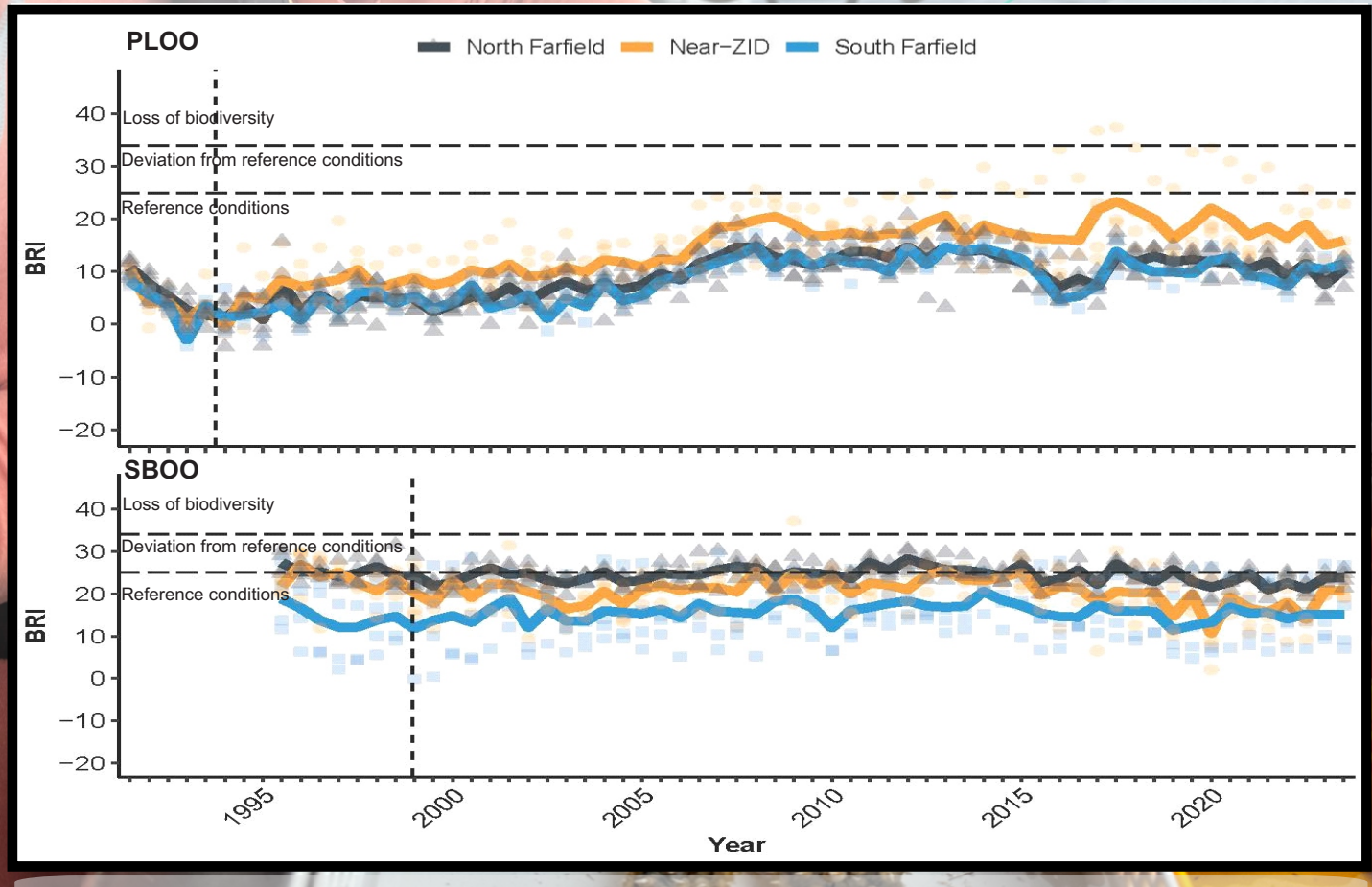
Gabriel Rodriguez and Lauren Valentino collecting sediment samples using a Van Veen grab sampler.

Veronica Rodriguez conducting taxonomic identifications in the lab.

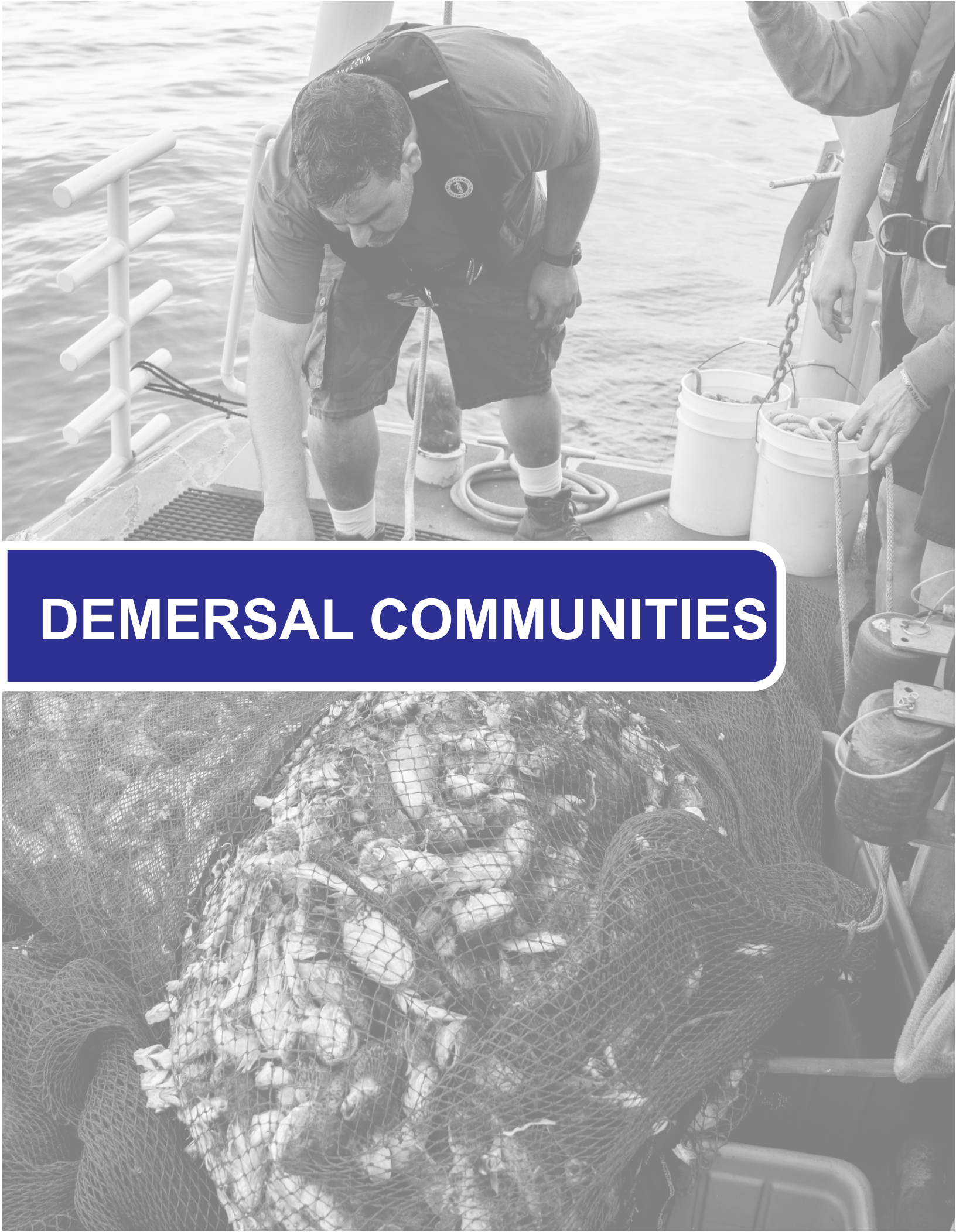
BENTHIC CONDITIONS

Benthic macrofaunal communities off San Diego also appeared to be healthy, with most assemblages appearing to be similar to those observed in the region since 1991, and throughout southern California and northern Baja California. Although communities varied across depth and sediment gradients, there was no evidence of disturbance or significant environmental degradation that could be attributed to anthropogenic factors, such as wastewater discharge. Instead, these communities segregated by habitat characteristics, such as depth and sediment particle size, often corresponding with the “patchy” habitats reported to occur naturally in southern California's offshore coastal waters.

The Benthic Response Index (BRI) further confirmed little evidence of disturbance off San Diego with 95% of all calculated BRI values being indicative of reference conditions, an improvement over previous reporting periods (2018–2019: 89%; 2020–2021: 94%). These results, when integrated with sediment chemistry and sediment toxicity results, demonstrated that the shelf off San Diego remains unimpacted by the PLOO or SBOO. Consequently, there is presently no evidence to suggest that wastewater discharge via the PLOO or SBOO is affecting the quality of benthic sediments off San Diego to the point that it may degrade resident marine biological communities.



Benthic Response Index (BRI) for the PLOO and SBOO regions over the past 30+ years indicating little evidence of disturbance off San Diego with almost all sites indicative of reference conditions (i.e. unimpacted by wastewater discharge). Vertical dashed lines indicate onset of wastewater discharge at each outfall's current location.

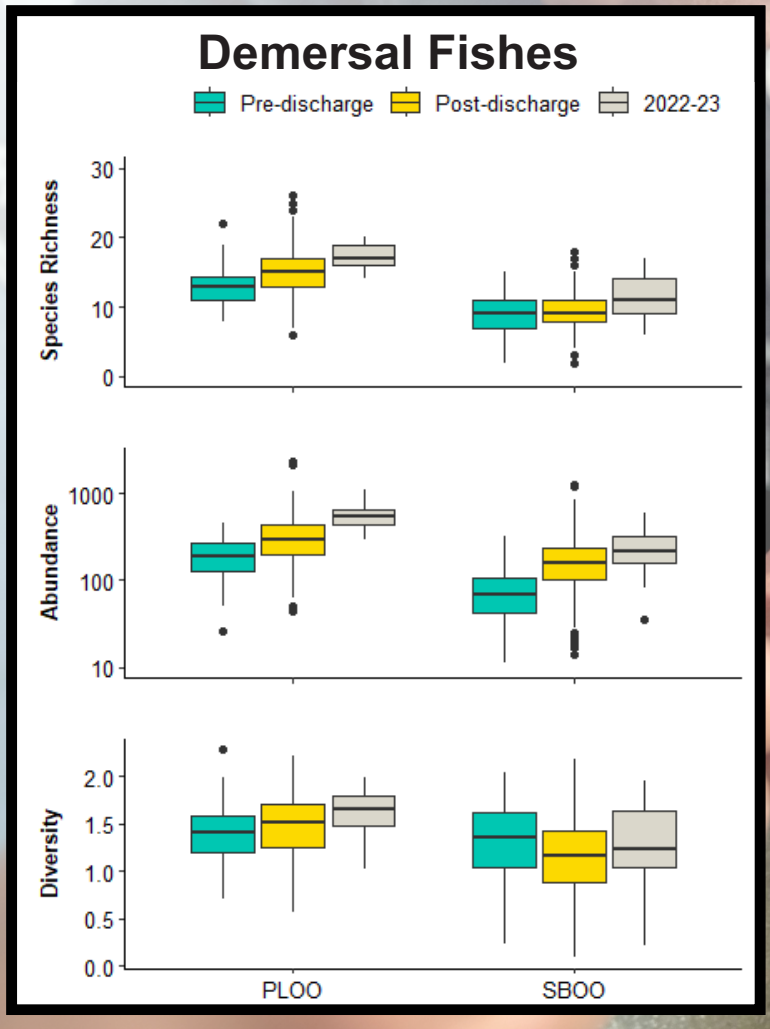


DEMERSAL COMMUNITIES

DEMERSAL COMMUNITIES

Demersal fish and megabenthic (trawl-caught) invertebrate communities trawled off San Diego remain unaffected by wastewater discharge. Although highly variable, patterns in the abundance and distribution of individual species were similar regardless of proximity to the outfalls and were representative of similar habitats throughout the Southern California Bight (SCB).

Fish assemblages in the PLOO region were dominated by the Pacific Sanddab (54% of fishes recorded in the region), and Speckled Sanddab dominated assemblages surrounding the SBOO (58% of fishes recorded in the region), as they have done since monitoring began in each region. Dover Sole, Halfbanded Rockfish and Longfin Sanddab were also prevalent in PLOO assemblages (24% of fishes recorded in the region), while Longfin Sanddab were also prevalent within the SBOO region during this period (12% of fishes recorded in the region). More than 80% of the species collected in the PLOO and SBOO monitoring regions were < 30 cm in length. External examination of fish collected indicated that fish populations remained healthy off San Diego, with fewer than 0.4% of all fish having external parasites or showing any evidence of disease or other abnormalities. As abnormalities or parasites were present across the region, there does not appear to be a relationship between these anomalies and proximity to either outfall.



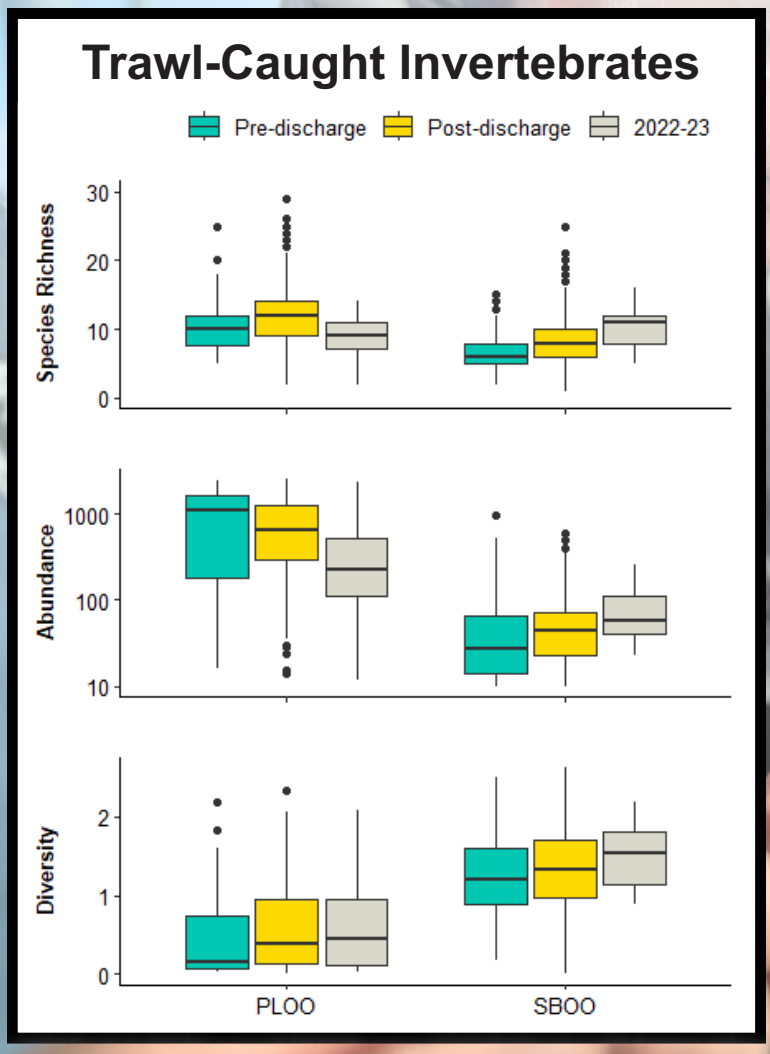
Species richness, abundance, and diversity of fish collected from the PLOO and SBOO regions indicating no negative impacts resulting from the onset of wastewater discharge.

Adriano Feit and Zoë Scott identifying a fish species during semi-annual trawl surveys.

City staff identifying and organizing fish for counting.

DEMERSAL COMMUNITIES

Trawl-caught **invertebrate assemblages** in the PLOO were dominated by the sea urchins *Lytechinus pictus* and *Strongylocentrotus fragilis* which accounted for 97% of the invertebrates recorded in the region. In contrast to the PLOO region, no single species dominated SBOO trawls over the reporting period. Rather, five species occurred in more than 50% of the hauls and accounted for between 2% to 30% of the total recorded invertebrates in the region, including the shrimps *Crangon nigromaculata* and *Sicyonia penicillata*, the sea stars *Astropecten californicus* and *Luidia armata*, and the snail *Philine auriformis*. No notable spatial patterns in megabenthic invertebrate community parameters were observed relative to the proximity of the PLOO or SBOO discharge sites and results were generally consistent with previous findings for the two regions and elsewhere in the SCB.



Species richness, abundance, and diversity of trawl-caught invertebrates collected from the PLOO and SBOO regions indicating no negative impacts resulting from the onset of wastewater discharge.

The abundance and distribution of fish and invertebrate species varied similarly at stations located near and far from the outfalls in both regions. The high degree of variability in these assemblages during this reporting period was similar to that observed in previous years, including before wastewater discharge began through either outfall. Furthermore, similar variability has been observed in comparable habitats elsewhere off the coast of southern California. Consequently, changes in local community structure of these fishes and invertebrates are more likely due to natural factors, such as changes in ocean temperatures associated with El Niño or other large-scale oceanographic events.

Wendy Enright recording invertebrate species abundance.

Fish and invertebrate communities in San Diego coastal waters remain unimpacted by wastewater discharge.

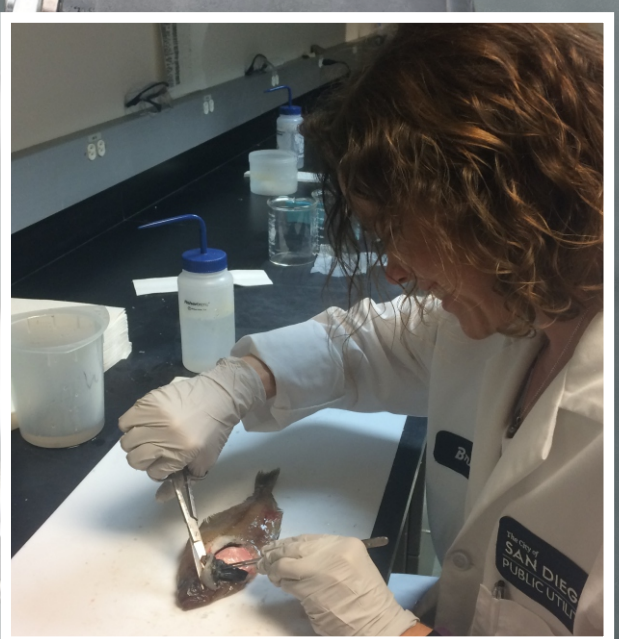
CONTAMINANTS IN FISHES

CONTAMINANTS IN FISHES

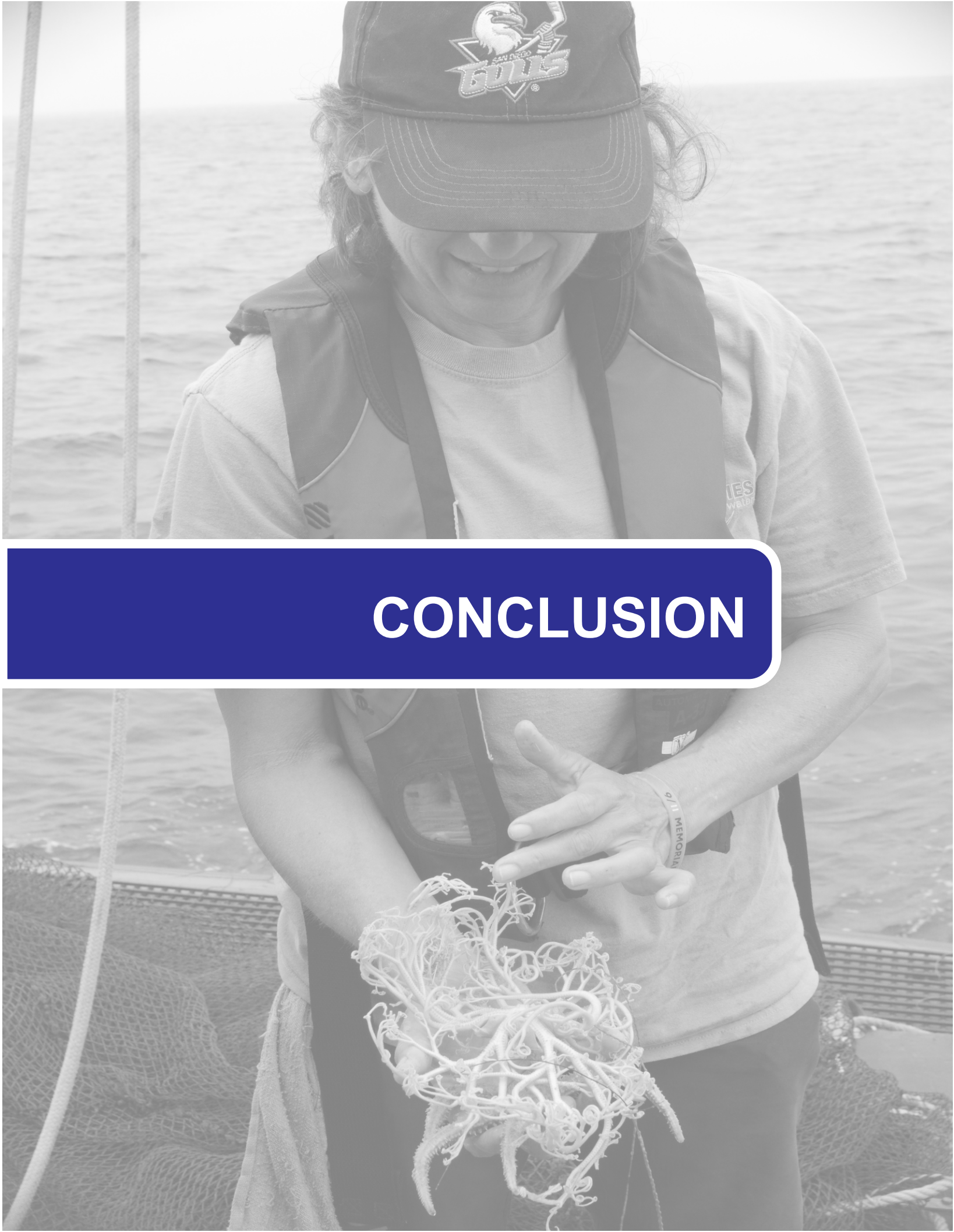
The accumulation of chemical contaminants in San Diego marine fishes varied across species and stations, but most values were within ranges reported previously for southern California fishes. Although several different trace metals, pesticides, and flame retardants (PBDEs) were detected in both liver and muscle tissues, these contaminants occurred in fishes distributed throughout both regions, with no patterns that could be attributed to wastewater discharge via the outfalls. Consequently, the occurrence of these contaminants in some local fishes off San Diego is likely influenced by other factors, such as the widespread distribution of many contaminants in southern California sediments, differences in the physiology and life history traits of various species of fish, different exposure pathways, and differences in the migration pathways of various species. For example, an individual fish may be exposed to contaminants at a polluted site, but then migrate to an area that is less contaminated. This is of particular concern for fishes collected in the vicinity of the PLOO and SBOO, as there are many other nearby potential point and non-point sources of contamination.

City staff rig fishing to sample fish for muscle and liver tissue analysis.

There was no evidence of contaminant accumulation in PLOO or SBOO fishes that could be associated with wastewater discharge from either outfall, which is consistent with historical findings.



Zoë Scott collecting muscle and liver tissue samples in the lab.



CONCLUSION

CONCLUSION

Coastal water quality conditions were generally excellent throughout the PLOO region, while SBOO stations, especially along the shore and near the mouth of the Tijuana River showed the highest frequency of elevated fecal indicator bacteria. A notable decline in water quality observed at offshore stations in the SBOO region this reporting period was likely driven by increased flows from the SBIWTP to the SBOO since August 2022 and limited primary treatment at the SBIWTP since March 2023. However, the overall spatial and temporal distribution of reduced water quality observations in the SBOO region corroborate previous findings, which suggest that the Tijuana River and other terrestrial inputs are the largest drivers of contamination in the SBOO region. Furthermore, precipitation, which is known to drive declines in water quality, especially at shore and kelp stations, was notably higher during the current report period compared to the previous report period likely further reducing water quality in the region. Thus, there was no evidence that treated wastewater was a driver of nearshore contamination, and no evidence that wastewater plumes from either of the two outfalls were transported shoreward into nearshore recreational waters. There were also no clear outfall related patterns in sediment contaminant distributions or differences between invertebrate and fish assemblages at the different monitoring sites. Additionally, benthic habitats surrounding both outfalls, and throughout the entire San Diego region, remained in good overall condition, similar to reference conditions for much of the SCB. Finally, the low level of contaminant accumulation, minimal sediment toxicity, and general lack of physical anomalies or other symptoms of disease or stress in local fishes was also indicative of a healthy marine environment off San Diego.

There was no evidence that treated wastewater was a driver of nearshore contamination, and no evidence that wastewater plumes from either of the two outfalls were transported shoreward into nearshore recreational waters.


2022 SOFTBALL CHAMPIONS
OPEN DIVISION
OTAY RANCH
DIVISION III
CALEXICO
DIVISION I
MATER DEI CATHOLIC
DIVISION IV
ESCONDIDO CHARTER
DIVISION II
GRANITE HILLS
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Water Quality Sampling
Benthic Sampling

OUTREACH

OUTREACH

In addition to the permit mandated sampling highlighted in this report, a goal of the Ocean Monitoring Program is to make data and resources easily accessible to the public. To this end, City staff continue to advance the program's outreach efforts by creating educational videos, attending outreach events, speaking with the media, and making all data and reports freely available via the City's website.

Over the course of the current reporting period we have made significant advances in sharing the City's ocean monitoring program data, which is now available for direct download via the City website (SanDiego.Gov/OceanMonitoring) and/or via the California Environmental Data Exchange Network (CEDEN). Furthermore, we continue to update the Ocean Monitoring Program website to allow for easier access to a number of resources to help the public better understand the importance of this program. We also regularly interact with the public and the media to share relevant information about the status of San Diego's coastal waters. We will continue to create and share content to help the public better understand the work of the Ocean Monitoring Program and encourage the public to reach out to our team, via the website, if they have any questions.

For more information and to access videos, data, reports etc. please go to SanDiego.Gov/OceanMonitoring.

Stephanie Jaeger presenting the City's Real-Time Moorings to a group of UCSD students.

Lauren Valentino and Zoë Scott representing at the Petco Park outreach event.

City staff using interactive games to share our important work with the public.

Zoë Scott educating the public on the City's Ocean Monitoring Program.

SanDiego.gov/OceanMonitoring