SURFACE WATER AMBIENT MONITORING PROGRAM: BIOACCUMULATION MONITORING PROGRAM REALIGNMENT

DATA REPORT FOR THE SAN DIEGO REGION

JUNE 2025

ACKNOWLEDGEMENTS

This Data Report was prepared by the Surface Water Ambient Monitoring Program (SWAMP) and the San Diego Regional Water Quality Control Board (R9) as part of the SWAMP Bioaccumulation Monitoring Program's Realignment efforts in the San Diego Region. The development of this Report was guided by the San Diego Region Realignment Advisory Committee.

San Diego Region Realignment Advisory Committee Members:

- Lisa Cumper, Jamul Indian Village
- Shasta Gaughen and Heidi Brow, Pala Band of Mission Indians
- Kelcey Stricker and Tiffany Wolfe, Pechanga Band of Luiseño Indians
- Cristina Torres and Arash Afghahi, Viejas Band of Kumeyaay Indians
- Sherri Norris, California Indian Environmental Alliance (CIEA)
- Jill Sherman-Warne, Native American Environmental Protection Coalition (NAEPC)
- José Bravo, Just Transition Alliance
- Ray Hiemstra, Orange County Coastkeeper
- Mitchell McKay, Citizens for Coastal Conservancy
- Matt O'Malley, San Diego Coast Keeper
- Emily Fudge, US Forest Service (USFS)
- Matthew Lucero, California Department of Fish and Wildlife (CDFW)
- Amy Smith, California Department of Public Health (CDPH)
- Wesley Smith, Office of Environmental Health Hazard Assessment (OEHHA)
- Peter Vroom, California Water Quality Monitoring Council & City of San Diego's Public Utilities Department
- Jay Davis, California Water Quality Monitoring Council Safe to Eat Workgroup & San Francisco Estuary Institute (SFEI)

SWAMP Realignment Team:

- Anna Holder, Realignment Lead, SWAMP Bioaccumulation Monitoring Program Coordinator, and Office of Information Management & Analysis Tribal Coordinator
- David Gibson, R9 Executive Officer

- Melissa Corona, R9 Tribal Coordinator
- Chad Loflen, R9 SWAMP Regional Coordinator
- Ali Dunn, SWAMP Leader
- Mike Antos, Realignment Meeting Facilitator, Stantec

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ACRONYMS AND ABBREVIATIONS

The below table defines acronyms and abbreviations that are used throughout this document.

Acronym or Abbreviation	Definition
CDPH	California Department of Public Health
CEDEN	California Environmental Data Exchange Network
Committee	San Diego Region Realignment Advisory Committee
DIT	Water Board's Division of Information Technology
OC pesticides	Organochlorine (OC) pesticides
OEHHA	California Office of Environmental Health Hazard Assessment
OPP	Water Board's Office of Public Participation
PBDEs	Polybrominated Diphenyl Ethers
PCBs	Polychlorinated Biphenyls
PFAS	Perfluoroalkyl and polyfluoroalkyl substances
Program	SWAMP Bioaccumulation Monitoring Program
QAPP	Quality Assurance Project Plan
Regional Boards	Nine Regional Water Quality Control Boards in California: • Region 1: North Coast Region • Region 2: San Francisco Bay Region • Region 3: Central Coast Region • Region 4: Los Angeles Region • Region 5: Central Valley Region • Region 6: Lahontan Region • Region 7: Colorado River Region • Region 8: Santa Ana Region • Region 9: San Diego Region
San Diego Water Board	San Diego Regional Water Quality Control Board
San Diego Region	San Diego Regional Water Quality Control Board Jurisdictional Boundaries
State Board	California State Water Resources Control Board
STEW	Safe to Eat Workgroup
SWAMP	Surface Water Ambient Monitoring Program
SWAMP IQ	SWAMP Information Management and Quality Assurance Center
Tribe(s)	California Native American Tribe(s)
Water Boards	California State Water Resources Control Board and Regional Water Quality Control Boards, collectively

INTRODUCTION

This document presents a data report for monitoring that took place in 2022 - 2023 as part of the SWAMP Bioaccumulation Monitoring Program (Program) Realignment in the San Diego Region. The Program Realignment effort was undertaken to better assess the condition of fish and shellfish for the purpose of consumption by Tribal and subsistence persons in the San Diego Region.

Since 2007, the Program and the Safe to Eat Workgroup have partnered to conduct surveys focused on collecting and analyzing fish tissue for mercury, legacy pesticides, and other bioaccumulated pollutants, such as PCBs (polychlorinated biphenyls), and assessing these data to provide insight into the safety of eating fish. These surveys have been conducted in lakes and reservoirs, rivers and streams, and coastal waters of California. However, targeted species and tissues historically have been focused on recreational fish consumption. Through these surveys, the Program has collected close to 100 different species during sampling of lakes, reservoirs, and coastal areas across the state, including in the San Diego Region. Tissue samples from those species were collected and analyzed in a manner that allows the Program's data to be used by the California Office of Environmental Health Hazard Assessment (OEHHA) to develop fish consumption advisories. To be able to develop consistent and robust advice statewide, OEHHA's Fish Advisories make the following assumptions that people are:

- consuming fish and shellfish at a recreational rate, which equates to approximately 1 - 4 servings per week depending on the person and the species they are consuming. Frequency categories are also included for those that may consume fish and shellfish up to 7 meals per week
- consuming only the skinless fish fillet
- consuming only the crustacean meat
- consuming only the bivalves animal tissue
- cooking the fish and/or shellfish meat before consuming it

The San Diego Region Realignment effort conducted targeted sampling in 2022 and 2023 according to the recommendations of Tribal and Community-Based Organization representatives on the San Diego Realignment Advisory Committee (Committee). Sampling was conducted at 10 waterbodies in the San Diego Region (Figure 1). While more waterbodies were identified for sampling, funding was limited and not all waterbodies were able to be sampled.

METHODS

A detailed description of the methods for sample collection and chemical analysis is provided in the Monitoring and Analysis Workplan (Monitoring Plan; Dec 2021). The methods are briefly summarized here, with a focus on information specific to the 2022-2023 San Diego Region Realignment effort.

Sample Collection

The Monitoring Plan called for collection of fish and shellfish from 9 first tier locations, with 13 additional second tier sites identified. Funding allowed for sampling of 10 total stations: 2 lake/reservoir locations, 2 river locations, and 6 coastal locations in 2022 (Figure 1). Unsampled sites are shown in Figure 2. Details of sample collection are provided in the Cruise Report (Mar 2023). Sampling at additional identified locations will be prioritized by the Program and San Diego Water Board SWAMP as funding and capacity are available [1].

[1] Note that sampling at Agua Hedionda and Batiquitos Lagoon jetties for shellfish was conducted in 2023 and 2024 by the San Diego Water Board. Results are not yet available.

Figure 1. Sampling locations for San Diego Region Realignment monitoring.

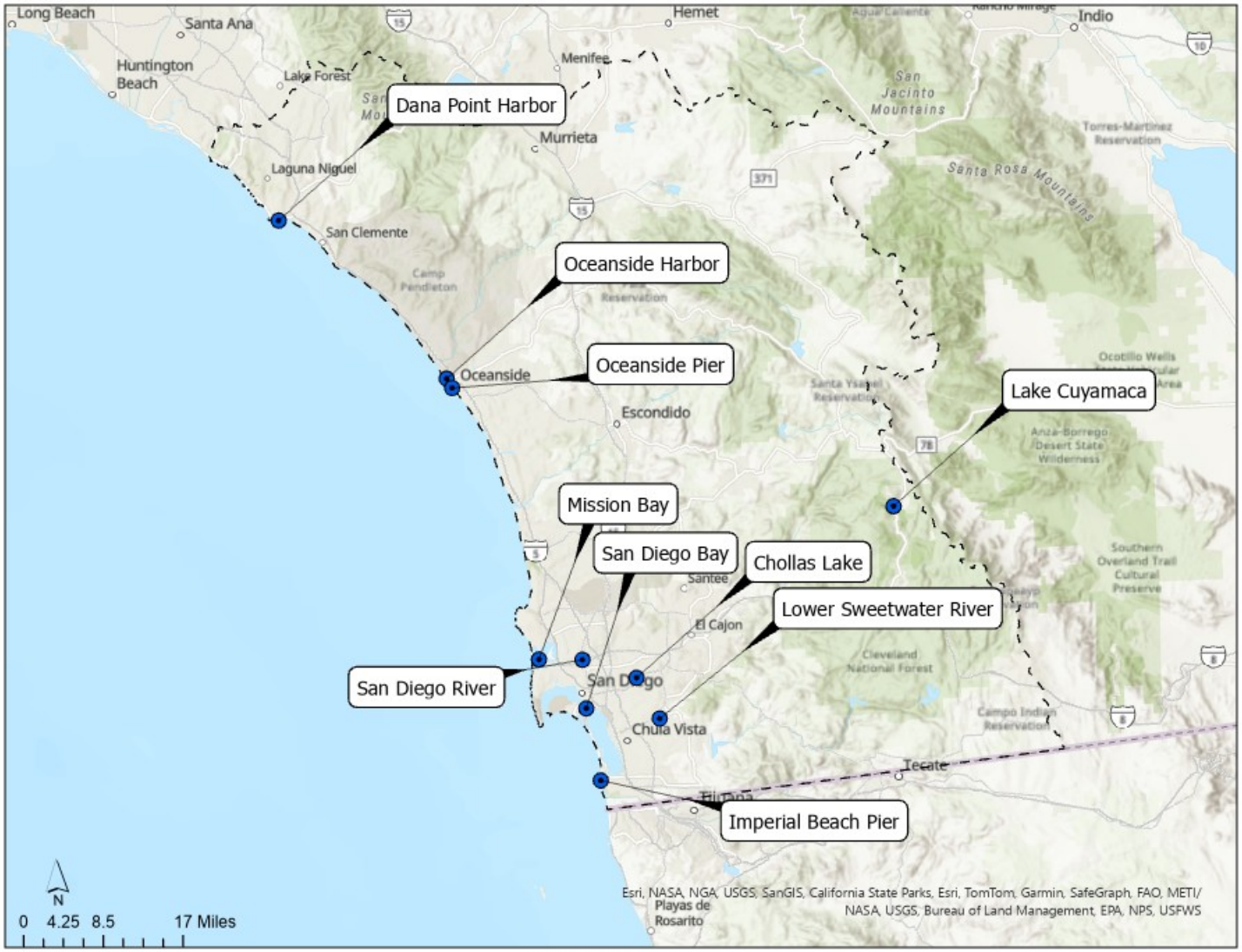

Figure 2. Sites identified as priorities for sampling that were not sampled due to funding limitations.

Sample Preparation and Analytical Methods

Samples were processed and distributed to the analytical laboratories as described in the Monitoring Plan by personnel at Moss Landing Marine Laboratories in Moss Landing, CA. Fish and shellfish samples were processed for analysis as whole organisms per direction of the San Diego Region Realignment Committee. Two fish samples were incorrectly processed as fillet-only and are denoted as such in the results. Some extra fish were also collected during sampling and run for mercury and selenium in fillets as part of a separate project. These are also reported in the results as supplemental information.

Pollutants analyzed and methods are found in Table 1. Because of funding limitations not all pollutants were run for all species sampled. All species were run for mercury and selenium, but some sites only had one higher-trophic level species run for organic pollutants (OC Pesticides, PCBs, PBDEs, PFAS). This was done to evaluate if future sampling and organics analysis is warranted on additional species in the waterbody. Analysis on additional species, including archived samples, will be prioritized when future San Diego Water Board SWAMP funds are available.

Table 1. Pollutants, Laboratories, and Analysis Method Used in Realignment

Pollutant	Laboratory	Method
Mercury	Moss Landing Marine Laboratories	EPA 7473M
Selenium	Moss Landing Marine Laboratories	EPA 200.8m
PCBs	SGS-Axys	EPA 1668AM
OC Pesticides	SGS-Axys	EPA 1699M
PBDEs	SGS-Axys	EPA 1614A
PFAS	SGS-Axys	EPA 1633

Specific information on method detection limits, reporting limits, quality assurance, and quality control are included in the Monitoring Plan. All concentrations are reported on a wet weight basis.

Data Management

The complete dataset for this study includes quality assurance data (quality control samples and field duplicates) and additional ancillary information (specific location information, fish sex, weights, and other information). The entire dataset is available via the California Environmental Data Exchange Network (CEDEN) under the "Tissue" category and by filtering by the Project Name "Statewide BMP Realignment RWB9 Study 2022." The entire dataset can also be found online at the project's GitHub webpage and also can be provided by the San Diego Water Board upon request.

Threshold Comparisons

Results from fish and shellfish tissue sampling are typically compared to OEHHA advisory tissue thresholds (ATLs) and/or fish contaminant goals ("FCGs", e.g. see Klasing and Brodberg 2008, 2011).

OEHHA Advisory Tissue Levels

According to OEHHA (Klasing and Brodberg 2008) "*ATLs are designed to encourage consumption of fish that can be eaten in quantities likely to provide significant health benefits, while discouraging consumption of fish that, because of contaminant concentrations, should not be eaten or cannot be eaten in amounts recommended for improving overall health.*" ATLs "*prevent consumers from being exposed to more than the average daily reference dose for non-carcinogens or to a risk level greater than 1x10-4 for carcinogens (not more than one additional cancer case in a population of 10,000 people consuming fish at the given consumption rate over a lifetime.*"

Per OEHHA recommendations, this report uses ATLs for comparison to observed pollutant levels. However, existing ATLs use consumption rates representative of recreational consumers (e.g. 32 grams/day). The San Diego Region Realignment Committee recommended OEHHA update or create new ATLs using published consumption rates representative of Tribal and subsistence consumers.

Consumption Rates Used in this Report

Overall San Diego Region consumption rates are not available for Tribal or subsistence groups. However, consumption rates are available from a San Diego Bay consumption study, which found rates of 74 grams/day for all anglers (99th percentile bay-wide) and 212 grams/day for the Asian subpopulation (99th percentile, see Steinberg and Moore 2017). A 2014 study of California Tribes found a consumption rate of 142 grams/day (95th percentile) and 240 grams/day (99th percentile, Schilling et al. 2014). Traditional Tribal use rates were estimated to be 223 grams/day (95th percentile, Schilling et al. 2014).

In the analysis below, we used 3 consumption rates for ATL development:

- 74 grams/day (SD Bay all anglers),
- 142 grams/day (Tribal 95th percentile), and
- 240 grams/day (Tribal 99th percentile, also protective of 99th percentile SD Bay rates).

Table 2 shows the number of meals per week based on each consumption rate. This allows the public to choose their representative consumption rate or adjust consumption based on study results. ATL numbers could be updated in the future for specific waterbodies if site-specific advice is available. Notably, the San Diego Bay consumption rates are those observed AFTER agencies posted consumption advice recommending the public limit consumption due to pollution.

Table 2. Consumption rate meals per week based on portion size.* Example use: If a person consumes or would like to consume 3 servings of fish or shellfish a week at a 12 oz portion size, they could use the 142 grams/day consumption rate to evaluate waterbody results.

Consumption Rate Advisory Category (grams/day)	Number Meals/Week Portion Size 8 oz	Number Meals/Week Portion Size 12 oz	Number Meals/Week Portion Size 16 oz
74	2	1.5	1
142	4.5	3	2
240	7.5	5	4

*Note meals/week rounded to nearest half number.

Cancer Risk Fish Contaminant Goals

We then compared results to cancer risk Fish Contaminant Goals (FCGs). FCGs are "*estimates of contaminant levels in fish that pose no significant health risk to individuals consuming sport fish at a standard consumption rate of eight ounces per week (32 g/day), prior to cooking, over a lifetime and can provide a starting point for OEHHA to assist other agencies that wish to develop fish tissue-based criteria with a goal toward pollution mitigation or elimination. FCGs prevent consumers from being exposed to more than the daily RfD for non-carcinogens or to a risk level greater than 1x10-6 for carcinogens (not more than one additional cancer case in a population of 1,000,000 people consuming fish at the given consumption rate over a lifetime). FCGs are based solely on public health considerations without regard to economic considerations, technical feasibility, or the counterbalancing benefits of fish consumption*" (Klasing and Brodberg 2008).

While the assumed consumption rate of FCGs is lower (1 meal per week: 8 oz) than used in the modified ATLs, the more conservative cancer risk level for some FCGs may be more important for individuals who face substantial pollutant burdens from chemical exposure in their environment beyond fish and shellfish consumption and want to know if it would be safe to eat 1 meal per week regardless of the health benefits associated with fish and shellfish consumption.

PFAS

FCGs or ATLs are not yet available for PFAS. As a result, OEHHA recommended the use of thresholds from other states. We used screening thresholds for individual PFAS from Massachusetts (0.22 ppb per PFAS, State of Massachusetts 2023). A concentration below 0.22 ppb for all individual PFAS compounds (PFBA, PFBS, PFHxS, PFOA, PFOS, PFNA, and GenX) would be protective for unlimited consumption of fish for both the general population and 1 meal per day for the sensitive population (PFOS only). Finally, we compared PFAS to the Washington State Department of Health 1 meal per week threshold (4.7 ppb, State of Washington 2022) and "do not eat" threshold for PFOS (28 ppb, State of Washington 2022).

RESULTS

Summary of Fish and Shellfish Collected

A total of 22 fish and 4 shellfish species were collected for analysis from a total of 10 lakes, rivers, and coastal sample locations (Table 3).

Table 3. List of Waterbodies and Fish and Shellfish Analyzed

Waterbody	Latitude	Longitude	Fish or Shellfish Analyzed	Species Name
Chollas Lake	32.7369	-117.063	Largemouth Bass	*Micropterus salmoides*
			Bluegill	*Lepomis macrochirus*
			Redear Sunfish	*Lepomis microlophus*
Cuyamaca, Lake	32.9886	-116.582	Black Crappie	*Pomoxis nigromaculatus*
			Bluegill	*Lepomis macrochirus*
			Largemouth Bass	*Micropterus salmoides*
			Green Sunfish	*Lepomis cyanellus*
			Common Carp	*Cyprinus carpio*
			Rainbow Trout	*Oncorhynchus mykiss*
Dana Point Harbor	33.4596	-117.696	Pacific Oyster	*Crassostrea gigas*
			Walleye Surfperch	*Hyperprosopon argenteum*
			Pacific Bonito	*Sarda chiliensis*
			Jacksmelt	*Atherinopsis californiensis*
			Chub Mackerel	*Scomber japonicus*
			Striped Mullet	*Mugil cephalus*
Imperial Beach Pier	32.5796	-117.137	California Corbina	*Menticirrhus undulatus*
			Pacific Bonito	*Sarda chiliensis*
			Jacksmelt	*Atherinopsis californiensis*
			Chub Mackerel	*Scomber japonicus*
			Queenfish	*Seriphus politus*
			Pacific Sardine	*Sardinops sagax*
			Barred Surfperch	*Amphistichus argenteus*
			California Mussel	*Mytilus californianus*
Sweetwater River at Morrison Pond	32.6729	-117.024	Bluegill	*Lepomis macrochirus*
San Diego River (Lower)	32.7672	-117.1616	Bluegill	*Lepomis macrochirus*
			Largemouth Bass	*Micropterus salmoides*
			Common Carp	*Cyprinus carpio*
			Bullhead	*Ameiurus nebulosus*
Mission Bay	32.7702	-117.239	California Spiny Lobster	*Panulirus interruptus*

Waterbody	Latitude	Longitude	Fish or Shellfish Analyzed	Species Name
			Pacific Oyster	*Crassostrea gigas*
			Pacific Bonito	*Sarda chiliensis*
			Spotfin Croaker	*Roncador stearnsii*
			Chub Mackerel	*Scomber japonicus*
			Jacksmelt	*Atherinopsis californiensis*
Oceanside Harbor	33.209	-117.401	California Spiny Lobster	*Panulirus interruptus*
			Chub Mackerel	*Scomber japonicus*
			Pacific Oyster	*Crassostrea gigas*
			Spotfin Croaker	*Roncador stearnsii*
			Pacific Bonito	*Sarda chiliensis*
			Barred Surfperch	*Amphistichus argenteus*
			Jacksmelt	*Atherinopsis californiensis*
Oceanside Pier	33.1916	-117.389	Barred Surfperch	*Amphistichus argenteus*
			Spotfin Croaker	*Roncador stearnsii*
			Barred Sand Bass	*Paralabrax nebulifer*
			Jacksmelt	*Atherinopsis californiensis*
			California Mussel	*Mytilus californianus*
			Queenfish	*Seriphus politus*
			Yellowfin Croaker	*Umbrina roncador*
San Diego Bay	32.6838	-117.148	Pacific Oyster	*Crassostrea gigas*
			Jack Mackerel	*Trachurus japonicus*
			Spotfin Croaker	*Roncador stearnsii*
			Spotted Sand Bass	*Paralabrax maculatofasciatus*
			Brown Bullhead	*Ameiurus nebulosus*
			Largemouth Bass	*Micropterus salmoides*
			Common Carp	*Cyprinus carpio*
			Bluegill	*Lepomis macrochirus*
			Rock Crab	*Metacarcinus gracilis*
			California Spiny Lobster	*Panulirus interruptus*

Due to funding limitations not all fish and shellfish species could be analyzed for all priority pollutants. For clarity of information results are presented below alphabetically by waterbody.

A concise tabular summary of the data for each sampling location is provided online at the project's GitHub webpage.

Chollas Lake

Chollas Lake was sampled for largemouth bass, bluegill, and sunfish. Bluegill and sunfish were only tested for mercury and selenium and values did not exceed ATLs or FCGs. Largemouth bass were tested for mercury, selenium, and organics (PCBs, pesticides, PBDEs) with results exceeding multiple ATLs and FCGs. Exceedances were driven by levels of PCBs and organochlorine pesticides. Levels of PFOS in largemouth bass were quite high, with PFOS levels of 60 ng/g, well above the do not eat threshold.

Table 4. Chollas Lake Species Analyzed and Exceedances of Safe Consumption Thresholds. Please see Table 2 for information on consumption levels for meals and grams/day or week.

Species	Above ATL 74 g/day	Above ATL 142 g/day	Above ATL 240 g/day	Above FCG	Above PFAS Action Level & 1 meal/day (227 g/day)	Above PFOS 1 meal/week (227 g/week)	Above PFOS Do Not Eat
Bluegill	No	No	No	NA	NA	NA	NA
Sunfish	No	No	No	NA	NA	NA	NA
Largemouth Bass	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Based on the results for largemouth bass, future sampling should target bluegill and sunfish for organic pollutants to determine if these fish species are above the ATLs and FCGs. The level of PFOS warrant testing for bluegill and sunfish for PFAS, as well as for any other potentially consumed species in the lake.

Cuyamaca, Lake

Lake Cuyamaca was sampled for largemouth bass, carp, crappie, bluegill, sunfish, and rainbow trout. Testing for all species (except largemouth bass) was limited to mercury and selenium with some crappie exceeding mercury ATLs. Largemouth bass were tested for mercury, selenium, and organics (PCBs, pesticides, PBDEs) with results exceeding multiple ATLs and FCGs. This was driven by levels of PCBs and mercury. Largemouth bass also exceeded the PFOS action level but not the do not consume threshold. Note that carp and rainbow trout were sampled but only fillets were analyzed (see below table).

Table 5. Lake Cuyamaca Species Analyzed and Exceedances of Safe Consumption Thresholds. Please see Table 2 for information on consumption levels for meals and grams/day or week.

Species	Above ATL 74 g/day	Above ATL 142 g/day	Above ATL 240 g/day	Above FCG	Above PFAS Action Level & 1 meal/day (227 g/day)	Above PFOS 1 meal/week (227 g/week)	Above PFOS Do Not Eat
Crappie	No	Yes	Yes	NA	NA	NA	NA
Bluegill	No	No	No	NA	NA	NA	NA
Carp (fillet, skin-off)	No	No	No	NA	NA	NA	NA
Sunfish	No	No	No	NA	NA	NA	NA
Largemouth Bass	Yes	Yes	Yes	Yes	Yes	Yes	No
Rainbow Trout (fillet, skin-off)	No	No	No	NA	NA	NA	NA

Based on the results for largemouth bass, future sampling should target additional species for organic pollutants to determine if these fish species are above the ATLs and FCGs as well as to determine levels of PFAS.

Dana Point Harbor

Dana Point Harbor was sampled for six fish and shellfish species: chub mackerel, jacksmelt, bonito, oyster, mullet, and walleye surfperch. All samples were run for organic pollutants except mullet, which was limited to mercury and selenium. PBDEs were only run on mackerel.

Table 6. Dana Point Harbor Species Analyzed and Exceedances of Safe Consumption Thresholds. Please see Table 2 for information on consumption levels for meals and grams/day or week.

Species	Above ATL 74 g/day	Above ATL 142 g/day:	Above ATL 240 g/day:	Above FCG	Above PFAS Action Level & 1 meal/day (227 g/day)	Above PFOS 1 meal/week (227 g/week)	Above PFOS Do Not Eat
Chub Mackerel	Yes	Yes	Yes	Yes	Yes	No	No
Jacksmelt	No	Yes	Yes	Yes	Yes	No	No
Bonito	No	No	No	No	Yes	No	No
Oyster	No	No	No	Yes	No	No	No
Striped Mullet	No	No	No	NA	NA	NA	NA

Species	Above ATL 74 g/day	Above ATL 142 g/day:	Above ATL 240 g/day:	Above FCG	Above PFAS Action Level & 1 meal/day (227 g/day)	Above PFOS 1 meal/week (227 g/week)	Above PFOS Do Not Eat
Walleye Surfperch	No	Yes	Yes	Yes	Yes	No	No

Only bonito and striped mullet **did not** exceed ATLs and FCGs at any level (and striped mullet analysis was limited). Mackerel exceeded all thresholds, driven by PCB concentrations (ATLs) and PCBs and DDTs (FCGs). PCBs and mercury were responsible for other threshold exceedances. PFAS were above the action level for all species tested except for oysters. No species exceeded the PFOS do not eat threshold.

Imperial Beach Pier

The Imperial Beach Pier (and adjacent waters) was sampled and analyzed for all species collected. A total of eight fish and shellfish species were collected: barred surfperch, corbina, chub mackerel, jacksmelt, mussels, bonito, sardine, and queenfish. Unlike other sites, for Imperial Beach Pier all samples collected, with the exception of sardines (low tissue amounts), were analyzed for mercury, selenium, and organic pollutants due to the cross-border sewage flows impacting the Imperial Beach sampling location. Extra tissue from corbina was used to run additional mercury and selenium analysis on skin-off fillets.

Table 7. Imperial Beach Pier Species Analyzed and Exceedances of Safe Consumption Thresholds. Please see Table 2 for information on consumption levels for meals and grams/day or week.

Species	Above ATL 74 g/day:	Above ATL 142 g/day	Above ATL 240 g/day	Above FCG	Above PFAS Action Level & 1 meal/day (227 g/day)	Above PFOS 1 meal/week (227 g/week)	Above PFOS Do Not Eat
Barred Surfperch	No	Yes	Yes	Yes	Yes	No	No
California Corbina	No	No	Yes	Yes	Yes	No	No
California Corbina (fillet, skin-off)	No	No	No	NA	NA	NA	NA
Chub Mackerel	No	No	Yes	Yes	Yes	No	No
Jacksmelt	No	Yes	Yes	Yes	Yes	No	No
Mussel	No	No	No	No	No	No	No

Species	Above ATL 74 g/day:	Above ATL 142 g/day	Above ATL 240 g/day	Above FCG	Above PFAS Action Level & 1 meal/day (227 g/day)	Above PFOS 1 meal/week (227 g/week)	Above PFOS Do Not Eat
Pacific Bonito	No	No	Yes	Yes	Yes	No	No
Pacific Sardine	No	No	No	NA	NA	NA	NA
Queenfish	Yes	Yes	Yes	Yes	Yes	No	No

Exceedances of thresholds were driven by PCBs, DDTs (FCG), and mercury. Notably, the only species that did not exceed any threshold, including PFAS, was the California mussel (sardine excluded due to limited tissue testing for only mercury and selenium). PFAS action levels were exceeded for all fish species analyzed. It should be noted that some impacts associated with sewage contamination were not measured by this study: this includes risks associated with bacterial and viral contamination of shellfish like mussels, which results in a substantially increased risk from consuming uncooked shellfish. This entire area is closed by the California Department of Public Health for any commercial shellfish propagation.

Mission Bay

Mission Bay had six fish and shellfish species collected and analyzed for mercury, selenium, and organic pollutants: California spiny lobster, chub mackerel, jacksmelt, pacific bonito, oyster, and spotfin croaker. Only chub mackerel was analyzed for PBDEs.

Table 8. Mission Bay Species Analyzed and Exceedances of Safe Consumption Thresholds. Please see Table 2 for information on consumption levels for meals and grams/day or week.

Species	Above ATL 74 g/day:	Above ATL 142 g/day:	Above ATL 240 g/day:	Above FCG	Above PFAS Action Level & 1 meal/day (227 g/day)	Above PFOS 1 meal/week (227 g/week)	Above PFOS Do Not Eat
CA Spiny Lobster	No	No	No	Yes	Yes	No	No
Chub Mackerel	No	Yes	Yes	Yes	Yes	No	No
Jacksmelt	No	Yes	Yes	Yes	Yes	No	No
Pacific Bonito	No	No	Yes	Yes	Yes	No	No
Pacific Oyster	No	No	No	Yes	No	No	No
Spotfin Croaker	Yes	Yes	Yes	Yes	No	No	No

For ATLs, exceedances were driven by mercury and PCBs. Spotfin croaker was the worst species, with exceedances at all consumption levels. All species were above FCGs, driven by PCBs (all) and chlordane (spotfin croaker). For PFAS, spotfin croaker and pacific oysters were below the action level, while all other species exceeded the action level.

Oceanside Harbor

Oceanside Harbor had seven species of fish and shellfish collected and analyzed for mercury, selenium, and organic pollutants: barred surf perch, California spiny lobster, chub mackerel, jacksmelt, pacific bonito, and spotfin croaker. Only chub mackerel was analyzed for PBDEs.

Table 9. Oceanside Harbor Species Analyzed and Exceedances of Safe Consumption Thresholds. Please see Table 2 for information on consumption levels for meals and grams/day or week.

Species	Above ATL 74 g/day:	Above ATL 142 g/day:	Above ATL 240 g/day:	Above FCG	Above PFOS Action Level & 1 meal/day (227 g/day)	Above PFOS 1 meal/week (227 g/week)	Above PFOS Do Not Eat
Barred Surfperch	No	Yes	Yes	Yes	Yes	No	No
CA Spiny Lobster	No	Yes	Yes	Yes	Yes	No	No
Chub Mackerel	No	Yes	Yes	Yes	Yes	No	No
Jacksmelt	Yes	Yes	Yes	Yes	No	No	No
Pacific Bonito	No	No	Yes	Yes	Yes	No	No
Pacific Oyster	No	No	Yes	Yes	No	No	No
Spotfin Croaker	Yes	Yes	Yes	Yes	No	No	No

For ATLs, exceedances were driven by PCBs and mercury, with jacksmelt and spotfin croaker exceeding at all levels due to PCBs. FCGs were exceeded for every species, driven by PCBs (all species), DDTs (barred surfperch, chub mackerel, jacksmelt, spotfin croaker), and dieldrin (barred surfperch). PFAS action levels were exceeded for all species except oyster, jacksmelt, and spotfin croaker. No species exceeded the do not eat threshold for PFOS.

Oceanside Pier

Oceanside Pier had seven fish and shellfish species collected and analyzed. Yellowfin croaker, queenfish, and barred sand bass were only analyzed for mercury and selenium. All other species included organics, with spotfin croaker being the only species analyzed for PBDEs. A fish processing error resulted in the processing of spotfin croaker as skin-off fillets. Additional lab analysis for mercury, selenium, and organics was thus conducted on spotfin croaker livers.

Table 10. Oceanside Pier Species Analyzed and Exceedances of Safe Consumption Thresholds. Please see Table 2 for information on consumption levels for meals and grams/day or week.

Species	Above ATL 74 g/day:	Above ATL 142 g/day:	Above ATL 240 g/day:	Above FCG	Above PFOS Action Level & 1 meal/day (227 g/day)	Above PFOS 1 meal/week (227 g/week)	Above PFOS Do Not Eat
Barred Sand Bass	No	Yes	Yes	NA	Yes	No	No
Barred Surfperch	No	Yes	Yes	Yes	Yes	No	No
California Mussel	No	No	No	No	No	No	No
Jacksmelt	Yes	Yes	Yes	Yes	NA	NA	NA
Queenfish	No	No	Yes	NA	NA	NA	NA
Spotfin Croaker Skin-off Fillet	No	Yes	Yes	No	No	No	No

Species	Above ATL 74 g/day:	Above ATL 142 g/day:	Above ATL 240 g/day:	Above FCG	Above PFOS Action Level & 1 meal/day (227 g/day)	Above PFOS 1 meal/week (227 g/week)	Above PFOS Do Not Eat
Spotfin Croaker Liver	No	Yes	Yes	Yes	NA	No	NA
Yellowfin Croaker	No	No	No	NA	NA	NA	NA

California mussel stands out as the only species which did not exceed ATLs or FCGs for mercury, selenium, and organics, in addition to not exceeding any PFOS threshold. For other species, ATL exceedances were driven by mercury and PCBs, while FCG exceedances were driven by PCBs (spotfin croaker, jacksmelt, surfperch) and dieldrin and DDTs (surfperch). Barred sand bass and surf perch exceeded the PFAS action level. While yellowfin croaker did not exceed thresholds for mercury or selenium, further testing of organics is warranted based on levels in other fish.

San Diego Bay

San Diego Bay had six fish and shellfish species analyzed for mercury, selenium, and organics, with PBDEs analyzed on spotted sand bass only. Additional skin-off fillet mercury data for spotted sand bass was collected and is included here.

Table 11. San Diego Bay Species Analyzed and Exceedances of Safe Consumption Thresholds. Please see Table 2 for information on consumption levels for meals and grams/day or week.

Species	Above ATL 74 g/day:	Above ATL 142 g/day:	Above ATL 240 g/day:	Above FCG	Above PFOS Action Level & 1 meal/day (227 g/day)	Above PFOS 1 meal/week (227 g/week)	Above PFOS Do Not Eat
CA Spiny Lobster	No	Yes	Yes	Yes	Yes	No	No
Rock Crab	No	Yes	Yes	Yes	Yes	No	No
Jack Mackerel	Yes	Yes	Yes	Yes	Yes	No	No
Pacific Oyster	Yes	Yes	Yes	Yes	Yes	No	No
Spotfin Croaker	Yes	Yes	Yes	Yes	Yes	No	No
Spotted Sand Bass	Yes	Yes	Yes	Yes	Yes	No	No
Spotted Sand Bass (fillet)	Yes	Yes	Yes	NA	NA	NA	NA

San Diego Bay had the highest rate of threshold exceedances of any waterbody sampled, with mercury, PCBs, and PFOS driving exceedances in both fish and shellfish. These results are especially of concern because documented consumption

rates in San Diego Bay were used in ATL development and show that beneficial uses associated with fish and shellfish consumption are clearly not being protected. Notably, the concentration of total PCBs in spotted sand bass were 393 ppb, which is **28 times higher** than the 74 g/day ATL threshold. The PFAS action level threshold was also exceeded in all samples analyzed, though no samples exceeded the do not eat threshold.

San Diego River

San Diego River had four fish species analyzed. Bluegill and largemouth bass were only analyzed for mercury and selenium; brown bullhead were analyzed for mercury, selenium and PCBs. Due to a processing error, common carp was not analyzed whole. Common carp skin-off fillet was analyzed for organics, including PBDEs, mercury, and selenium. Common carp livers were also analyzed for mercury and selenium.

Table 12. San Diego River Species Analyzed and Exceedances of Safe Consumption Thresholds. Please see Table 2 for information on consumption levels for meals and grams/day or week.

Species	Above ATL 74 g/day:	Above ATL 142 g/day:	Above ATL 240 g/day:	Above FCG	Above PFOS Action Level & 1 meal/day (227 g/day)	Above PFOS 1 meal/week (227 g/week)	Above PFOS Do Not Eat
Bluegill	No	No	Yes	NA	Yes	Yes	Yes
Largemouth Bass	No	Yes	Yes	NA	Yes	Yes	Yes
Brown Bullhead	No	No	Yes	Yes	Yes	Yes	No
Common Carp Skin Off Fillet	No	Yes	Yes	Yes	Yes	Yes	Yes
Common Carp Liver	Yes	Yes	Yes	NA	Yes	Yes	Yes

Observed ATL exceedances for largemouth bass and bluegill were driven by mercury, with brown bullhead was due to PCBs. Common carp was more complicated due to the processing error. Common carp skin-off fillet exceedance were driven by mercury, total PCBs, and PBDEs, while common carp liver exceedances were due to selenium. The liver results are not applicable unless a person is consuming carp livers at the respective rates of 74, 142, or 240 grams per day,

which is improbable (indicated by shaded grey cells in the table). However, all ATL and FCG results are overshadowed by PFOS results, which were well above the do not eat threshold for every species sampled except brown bullhead (12 ppb). The do not eat threshold (27 ppb) was exceeded in largemouth bass (372 ppb), bluegill (106 ppb), as well as common carp fillet (34 pbb) and liver (258 ppb).

Sweetwater River, Lower

The lower Sweetwater River (below Otay Reservoir) was challenging to sample due to lack of surface waters in the river supporting fish populations. Sampling occurred at Morrison Pond, a permanent pond in the lower river. Only bluegill were caught in the pond, with enough caught to run mercury, selenium, and organics (including PBDEs). Skin-off fillet samples for bluegill were also analyzed for mercury and selenium due to the limited number of species caught.

Table 13. Sweetwater River Species Analyzed and Exceedances of Safe Consumption Thresholds. Please see Table 2 for information on consumption levels for meals and grams/day or week.

Species	Above ATL 74 g/day:	Above ATL 142 g/day:	Above ATL 240 g/day:	Above FCG	Above PFOS Action Level & 1 meal/day (227 g/day)	Above PFOS 1 meal/week (227 g/week)	Above PFOS Do Not Eat
Bluegill	No	No	Yes	Yes	Yes	Yes	Yes
Bluegill Skin-off Fillet	No	Yes	Yes	NA	NA	NA	NA

Bluegill at Morrison Pond on the Lower Sweetwater River exceeded ATLs at multiple levels due to concentrations of mercury, with higher concentrations in fillets than whole organism. FCGs were also not met due to concentrations of chlordane, DDTs, Dieldrin, and PCBs. However, like the San Diego River, these results are overshadowed by PFOS results, which exceeded the do not eat threshold (28 pbb) by a factor of 7 (217 ppb).

DISCUSSION

The results from this Realignment monitoring have provided a baseline condition assessment in the San Diego Region from which additional monitoring efforts can be supplemented through the addition of more sites, species, and pollutants, as well as to track changes over time. Monitoring was successfully completed at all priority sites and for priority pollutants, though funding was insufficient to sample all species for all priority pollutants at all sites.

Overall results showed the consumption of most species carries an elevated cancer and non-cancer risk, especially when consumed at higher rates and using alternative preparation methods (whole organism vs. fillet).

The species that exhibited the lowest risk were mussels and oysters (except for in San Diego Bay and Imperial Beach), though it should be noted filter feeders should **not** be consumed during shellfish quarantine periods due to the risk of shellfish poisoning from diatoms and/or dinoflagellates, making shellfish an option for consumption only part of the year. Updated information on shellfish closures is provided by the California Department of Public Health.

The locations carrying the highest levels of risk from consumption were San Diego Bay, driven by PCBs and Mercury, and the lower San Diego and Sweetwater Rivers, driven by PFAS.

The selection and analysis of multiple species per site allows the public to identify those species to consume that pose less health risk, and also adjust consumption rates, if possible, to reduce risk. However, only a subset of sampled species were able to be analyzed for PFAS. Thus, some species (e.g., yellowfin croaker at Oceanside Pier) had low levels of pollutants but were NOT analyzed for PFAS. This is a significant concern because PFAS results from across the region show that inclusion of PFAS in tissue sampling needs to occur for accurate health risk to be assessed. For example, in the lower San Diego River PFAS results recommend a “do not eat” for every species but bullhead (which doesn’t meet the 1 meal/week threshold). If PFAS were not sampled in the San Diego River the analysis would be based only on other pollutants and would have indicated that a high level of consumption would not pose health a health risk which, thanks to our PFAS data, we know is incorrect.

This study represents the first large-scale assessment of PFAS in fish and shellfish tissue in the San Diego Region. The results show that almost all fish sampled were above the PFAS action level, suggesting that some limits on consumption are warranted and highlighting the need for California to develop PFAS tissue thresholds levels and goals.

In response to Realignment conversations and these results, the San Diego Water Board has procured additional funding to analyze all SWAMP archived tissue samples from the San Diego Region for PFAS, including for samples from this study that were not analyzed (over 100 samples in all). This will allow for a more complete picture of PFAS impacts across the region while providing OEHHA access to additional data to consider for issuance of consumption advice. This will also assist in determining potential patterns in PFAS concentrations among sites and species, as initial results show the highest observed levels in urban freshwater locations.

NEXT STEPS AND RECOMMENDATIONS

The results from the San Diego Region Realignment show that additional actions are needed and warranted, including recommendations for existing statewide programs.

Future action recommendations include:

1) Conducting additional PFAS analysis on available archived samples.

2) Update the requirements under Assembly Bill 2872 (Shelley 1999):
    a. Include PFAS in analysis.
    b. Include Tribal and subsistence species and preparation methods.

3) Development of tissue guidance for PFAS by OEHHA and updates to existing site-specific fish consumption advisories.

The first next step, which is already underway, is to analyze all archived samples for PFAS. Archived samples were shipped to the analytical laboratory for analysis in Dec 2024, with results expected in late 2025. While most samples are skin-off fillets, the analysis of over 140 samples across multiple waterbodies and species in the region will provide additional baseline information on PFAS levels.

Second, the SWAMP Realignment Team also recommends updates be made to the required monitoring under Assembly Bill 2872 (Shelley 1999) to include chemical analysis of PFAS and representation of Tribal and subsistence consumption. AB 2872 requires the State Water Board to implement a comprehensive coastal monitoring and assessment program (Program) for sport fish and shellfish. The Program is required to identify and monitor chemical contamination in coastal fish and shellfish and assess the health risks of consumption of sport fish and shellfish caught by consumers at a minimum of 40 sites sampled every 5 years. AB 2872 also requires The State Water Board to consult with the Department of Fish and Wildlife (formerly Fish and Game), the OEHHA, and Regional Water Quality Control Boards, including the San Diego Region, with jurisdiction over territory along the coast, to determine chemicals, sampling locations, and the species to be collected under the Program.

Based on the findings of this study, the SWAMP Realignment Team recommends that PFAS be added to the monitoring of chemical contamination under AB 2872. While PFAS analysis in fish and shellfish is limited to date, this study as well as work in San Francisco Bay (Mendez et al. 2025) has documented levels of PFAS that exceed consumption criteria, warranting the additional of PFAS to the Program's standard chemical analysis suite. AB 2872 also only applies to **sport** fish and shellfish, as well as only coastal locations, and thus should be updated. To date the focus on sport fish has meant the collection and analysis of fish fillets and sport fish and shellfish which omits other preparation methods and species. AB 2872 should be updated to specifically include Tribal and subsistence fish and shellfish species and preparation methods in addition to including locations that are important for Tribal and subsistence consumption.

Third, the SWAMP Realignment Team also recommends the development of tissue guidance for PFAS by OEHHA to better assist in the evaluation of PFAS results. We also recommend updating and/or developing new waterbody-specific consumption advice that incorporates risk associated with PFAS. Otherwise the public will continue to make consumption decisions based on information that underestimates health risks from consumption. Similarly, the development of fish and shellfish consumption advice by OEHHA has focused on recreational sport consumption. Future advice should also include Tribal and subsistence locations and preparation methods.

Finally, the San Diego Water Board intends to use future regional SWAMP funding to continue the Realignment work by targeting the additional waterbodies and species that were prioritized by Tribal and subsistence representatives but were unable to be sampled. Updates on future work and progress can be tracked and obtained by participation in the SWAMP Safe to Eat Workgroup.

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