



Health Advisory and Guidelines for Eating Fish from San Diego Bay (San Diego County)

Updated July 2018



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LIST OF ACRONYMS AND ABBREVIATIONS

ATL	Advisory Tissue Level
CDFW	California Department of Fish and Wildlife
CFCP	Coastal Fish Contamination Program
DDT(s)	dichlorodiphenyltrichloroethane (DDT) and its metabolites dichlorodiphenyldichloroethane (DDD) and dichlorodiphenyldichloroethylene (DDE)
DHA	docosahexaenoic acid
EPA	eicosapentaenoic acid
FDA	Food and Drug Administration
Hg	mercury
MDL	method detection limit
MLML	Moss Landing Marine Laboratories
mm	millimeters
NOAA	National Oceanic and Atmospheric Administration
OEHHA	Office of Environmental Health Hazard Assessment
PBDEs	polybrominated diphenyl ethers
PCBs	polychlorinated biphenyls
ppb	parts per billion
RL	reporting limit
RWB9	Regional Water Board 9 (San Diego)
SDRWQCB	San Diego Regional Water Quality Control Board
Se	selenium

SWAMP	Surface Water Ambient Monitoring Program
USDA	United States Department of Agriculture
USDHHS	United States Department of Health and Human Services
US EPA	United States Environmental Protection Agency

PREFACE

The Office of Environmental Health Hazard Assessment (OEHHA), a department in the California Environmental Protection Agency, is responsible for evaluating potential public health risks from chemical contamination of sport fish. This includes issuing fish consumption advisories, when appropriate, for the State of California. OEHHA's authorities to conduct these activities are based on mandates in the:

- California Health and Safety Code
 - Section 59009, to protect public health
 - Section 59011, to advise local health authorities
- California Water Code
 - Section 13177.5, to issue health advisories

The health advisories are published in the California Department of Fish and Wildlife Sport Fishing Regulations in the section on public health advisories.

This report presents updated guidelines for eating fish from San Diego Bay in San Diego County. The report provides background information and a technical description of how the guidelines were developed. The resulting advice is summarized in the illustrations after the Table of Contents and List of Figures and Tables.

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A GUIDE TO EATING FISH from SAN DIEGO BAY (SAN DIEGO COUNTY)

Women (18-45 Years)
Children (1-17 Years)

2 TOTAL SERVINGS A WEEK

OR

2 TOTAL SERVINGS A WEEK

OR

1 TOTAL SERVING A WEEK

OR

0 DO NOT EAT

OR

0 DO NOT EAT

Women (46+ Years)
Men (18+ Years)

7 TOTAL SERVINGS A WEEK

OR

2 TOTAL SERVINGS A WEEK

OR

2 TOTAL SERVINGS A WEEK

OR

1 TOTAL SERVING A WEEK

OR

0 DO NOT EAT

Eat the Good Fish
Eating fish that are low in chemicals may provide health benefits to children and adults.

Avoid the Bad Fish
Eating fish with higher levels of chemicals like mercury or PCBs may cause health problems in children and adults.

Choose the Right Fish
Chemicals may be more harmful to unborn babies and children.

Pile Perch	Rainbow Surfperch			
Diamond Turbot	Spotted Turbot			
Black Perch	Round Stingray	Shovelnose Guitarfish	(California) Spiny Lobster	
Sharks	Barred Sand Bass	Spotted Sand Bass	Pacific Chub Mackerel	Yellowfin Croaker
Shiner Perch	Topsmelt			

Serving Size
A serving of fish is about the size and thickness of your hand. Give children smaller servings.

For Adults

For Children

California Office of Environmental Health Hazard Assessment

web www.oehha.ca.gov/fish
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Eat only the skinless fillet

Some chemicals are higher in the skin, fat, and guts.

Eat only the meat

Updated 07/2018

INTRODUCTION

This report presents an update and supersedes the previous advice for eating fish from San Diego Bay (Figure 1) in San Diego County, located in coastal southern California. This update provides new advice for Spiny Lobster, removes advice for California Lizardfish, and alters the previous advice for Pacific Chub Mackerel and surfperch species. Specific changes in fish consumption guidelines for San Diego Bay are discussed in further detail in the *Consumption Advice for Fish from San Diego Bay* section of this report.

Location

San Diego Bay is a natural harbor approximately 11 miles long and 2 miles wide at its widest point, with 34 miles of waterfront along the cities of San Diego, Chula Vista, Imperial Beach, National City, and Coronado¹. The southern end is located approximately three miles north of the California-Mexico border. San Diego Bay is popular for fishing, both from shore and by boat.

FIGURE 1. LOCATION OF SAN DIEGO BAY



¹ <https://www.portofsandiego.org/>

APPROACH USED

The Office of Environmental Health Hazard Assessment (OEHHA) used the results from three monitoring studies described in this report to develop the San Diego Bay Advisory. OEHHA uses the following general process in developing consumption advice for sport fish:

- 1) Evaluation of all fish contaminant data available from a water body and selection of appropriate data that meet data quality criteria and sampling plan guidelines.
- 2) Determination of fish species for which adequate data are available to issue fish consumption advice.
- 3) Calculation of an appropriate measure of central tendency (often a weighted arithmetic mean²) and other descriptive statistics of the contaminant data, as appropriate, for a chemical of potential concern for the selected fish species.
- 4) Comparison of the chemical concentrations with the OEHHA Advisory Tissue Levels (ATLs) for each chemical of potential concern.
- 5) Development of final advice based on a thorough review of the data and best professional judgment relating to the benefits and risks of consuming a particular fish species.

The ATLs (discussed further in a subsequent section of this report) are chemical levels in fish tissue that are considered acceptable, based on chemical toxicity, for a range of consumption rates. Development of the ATLs also included consideration of health benefits associated with including fish in the diet (OEHHA, 2008 and 2011). The ATLs should not be interpreted as static “bright lines,” but one component of a complex process of data evaluation and interpretation used by OEHHA in the assessment and communication of the benefits and risks of consuming sport fish.

CHEMICALS OF POTENTIAL CONCERN

Certain chemicals are considered to be a potential concern for people who eat fish because of their toxicity and their ability to accumulate in fish tissue. The majority of fish consumption advisories in California are issued because of mercury (Hg), followed by polychlorinated biphenyls (PCBs) and, in a few cases, selenium (Se) or some legacy pesticides (pesticides that are no longer used but remain in the environment).

Mercury is a natural element found in some rock and soil. Human activities, such as burning coal and the historic use of mercury to mine gold, also add mercury to the environment. If mercury enters waterways, it can be converted to a more toxic form

² Means are an arithmetic average of individual values and/or a weighted average of composites. A weighted average of composites is calculated by multiplying the chemical concentration in each composite by the number of fish in that composite for each species. Products are then summed and divided by the total number of fish in all composites for that species, combined.

known as methylmercury – which can pass into and build up in fish. High levels of methylmercury can harm the brain, especially in fetuses and children.

PCBs are industrial chemicals previously used in electrical transformers, plastics, and lubricating oils, often as flame retardants or electrical insulators. Their use was banned in the 1970s, but they persist in the environment because they do not break down easily and can accumulate in fish. Depending on the exposure level, PCBs may cause cancer or other health effects, including neurotoxicity, in humans.

Selenium is a naturally occurring metalloid and at low doses is an essential nutrient for many important human health processes, including thyroid regulation and vitamin C metabolism. Higher doses cause selenium toxicity, which can include symptoms ranging from hair loss and gastrointestinal distress to dizziness and tremors.

Chlordanes, dichlorodiphenyltrichloroethane (DDT), dieldrin, and toxaphene are pesticides that were banned from use in 1973 (DDT), the late 1980s (chlordanes and dieldrin) and 1990 (toxaphene), but are still found in some fish in certain water bodies in California. Depending on the exposure level, these chemicals may cause cancer or adverse effects on the nervous system.

Polybrominated diphenyl ethers (PBDEs) are a class of flame retardants historically used in a variety of consumer products including furniture, textiles, automotive parts, and electronics. The use of PBDEs in new products was largely phased out by 2013 but, due to their wide usage and persistence in the environment, they are still being detected in fish tissues. PBDEs may affect hormone levels or learning and behavior in children.

Detailed discussion of the toxicity of these chemicals and references are presented in “Development of Fish Contaminant Goals and Advisory Tissue Levels for Common Contaminants in California Sport Fish: Chlordane, DDTs, dieldrin, methylmercury, PCBs, selenium, and toxaphene” (OEHHA, 2008) and “Development of Fish Contaminant Goals and Advisory Tissue Levels for Common Contaminants in California Sport Fish: Polybrominated Diphenyl Ethers (PBDEs)” (OEHHA, 2011).

All fish species collected from San Diego Bay and used in advisory development were analyzed for mercury (as a measure of methylmercury) and PCBs. Barred Sand Bass, Black Perch, Diamond Turbot, Gray Smoothhound Shark, Leopard Shark, Pacific Chub Mackerel, Rainbow Surfperch, Shiner Perch, Shovelnose Guitarfish, Spiny Lobster, Spotted Sand Bass, Spotted Turbot, Topsmelt, and Yellowfin Croaker were also analyzed for the legacy pesticides: chlordanes, dieldrin, DDTs (DDT and its metabolites dichlorodiphenyldichloroethane [DDD] and dichlorodiphenyldichloroethylene [DDE]), selenium, and toxaphene (Spiny Lobster was not analyzed for toxaphene). Spotted Sand Bass and Pacific Chub Mackerel were further analyzed for PBDEs.

DATA SOURCES

The guidelines for eating fish from San Diego Bay are based on the chemicals detected in the fish collected for the three monitoring studies described below. These studies met OEHHA's data quality criteria, including adequate documentation of sample collection, fish preparation method (e.g., skinning or filleting), chemical analyses, quality assurance, and sufficiently low detection limits. "Sample," as used in this report, refers to an individual fish or a composite of multiple fish for which contaminant data was reported. "Sampling" or "sampled" refers to the act of collecting fish for chemical analysis.

COASTAL FISH CONTAMINATION PROGRAM (CFCP), 1999-2002

The CFCP (1998-2003) was a statewide monitoring program managed by the State Water Resources Control Board (SWRCB) to assess human health risks from eating sport fish and shellfish caught from nearshore (marine and estuarine) waters in California (Gassel, 2005). The program was halted after five years due to budget constraints. California Department of Fish and Wildlife (CDFW) staff, then known as the California Department of Fish and Game, in cooperation with staff and representatives from SWRCB and the Regional Water Quality Control Boards, collected Barred Sand Bass, Black Perch, Pacific Chub Mackerel, Diamond Turbot, Gray Smoothhound Shark, Leopard Shark, Pile Perch, Rainbow Surfperch, Round Stingray, Shiner Perch, Shovelnose Guitarfish, Spotted Sand Bass, Spotted Turbot, Topsmelt, and Yellowfin Croaker in 1999 through 2002 from San Diego Bay as part of the program. Pile Perch and Round Stingray were analyzed for mercury and PCBs. All other fish samples were analyzed for chlordanes, dieldrin, DDTs, mercury, PCBs, selenium, and toxaphene.

SURFACE WATER AMBIENT MONITORING PROGRAM (SWAMP): CONTAMINANTS IN FISH FROM THE CALIFORNIA COAST, 2009

The SWAMP, operated by the SWRCB, monitors water quality in California's surface waters. From 2009-2010, the program performed a statewide survey of coastal waters to evaluate contaminants in commonly consumed sport fish and to gain information about contamination in the greater aquatic food web (SWRCB, 2012). The survey collected Barred Sand Bass, Gray Smoothhound Shark, Pacific Chub Mackerel, Shiner Perch, Spotted Sand Bass, and Yellowfin Croaker from San Diego Bay in 2009 to analyze chlordanes, dieldrin, DDTs, mercury (except Pacific Chub Mackerel), PCBs, and selenium.

SAN DIEGO REGIONAL WATER QUALITY CONTROL BOARD MONITORING PROGRAM (RWB9), 2014-2015

The RWB9 coordinates ongoing sampling efforts to monitor contaminant levels, including mercury, in sport fish caught from water bodies within the region (SDRWQCB, 2017). RWB9 collected Spiny Lobster from San Diego Bay in 2014 and 2015. Spiny Lobster were analyzed for chlordanes, dieldrin, DDTs, mercury, PCBs, and selenium.

FISH SAMPLED FROM SAN DIEGO BAY

The fish sampling data used in this advisory were retrieved from the California Environmental Data Exchange Network (CEDEN), the State's repository for environmental data, the State Water Resources Control Board, and the San Diego Regional Water Quality Control Board. Samples were excluded when the fish were not legal size to take or did not meet OEHHA's criteria for minimum "edible" size based on species size at maturity, and professional judgment (as described in OEHHA, 2005), except for Barred Sand Bass, Spotted Sand Bass, Pacific Chub Mackerel, and Topsmelt (see discussion for those species below).

There were insufficient PCB data for Pacific Chub Mackerel of minimum edible length (i.e. 360 mm). To consider potential multi-chemical exposures to both mercury and PCBs, PCB data from five composite samples of undersized fish (i.e. 204-352 mm) were included in the analysis to develop sufficiently health protective advice for this species. Final consumption advice for the sensitive population was based on the potential exposure risk that considered both the mean mercury concentration of adequately sized fish and the mean PCB concentration in undersized fish. Advice for the general population was based on PCB concentrations. OEHHA determined that using the PCB data from undersized fish was more health protective than basing advice on mercury alone.

All samples used to develop advice for Topsmelt in the initial San Diego Advisory were below the minimum edible length (150 mm). However, as the PCB levels observed in the undersized fish were sufficient to develop no consumption advice for both the sensitive and general populations, advice for this species was retained in this advisory update. A summary of all fish species evaluated for this advisory is shown in Table 1, including the name of the species, number of samples collected, total number of fish, project name, year sampled, and contaminants analyzed.

Effective in 2013, the California Fish and Game Commission changed the minimum legal size (total length) for saltwater basses, including Barred and Spotted Sand Bass species, from 12 inches (305 mm) to 14 inches (356 mm)³. There were insufficient numbers of legal-sized fish samples to develop advice for these two species. However, there were sufficient data to develop advice based on the previous legal size of 12 inches (305 mm). To develop consumption advice for the initial San Diego Bay Advisory, OEHHA performed regression analyses to evaluate the relationship between size (total length) and mercury or PCB concentrations in each of the individual sand bass species, and determined that advice based on samples measuring at least 12

³ California Code of Regulations Title 14, section 28.30; Kelp Bass, Barred Sand Bass and Spotted Sand Bass. Available at:

[https://govt.westlaw.com/calregs/Document/IA500548061EA11E2A00EE7F91C5B908E?viewType=FullText&originationContext=documenttoc&transitionType=CategoryPageItem&contextData=\(sc.Default\)](https://govt.westlaw.com/calregs/Document/IA500548061EA11E2A00EE7F91C5B908E?viewType=FullText&originationContext=documenttoc&transitionType=CategoryPageItem&contextData=(sc.Default))

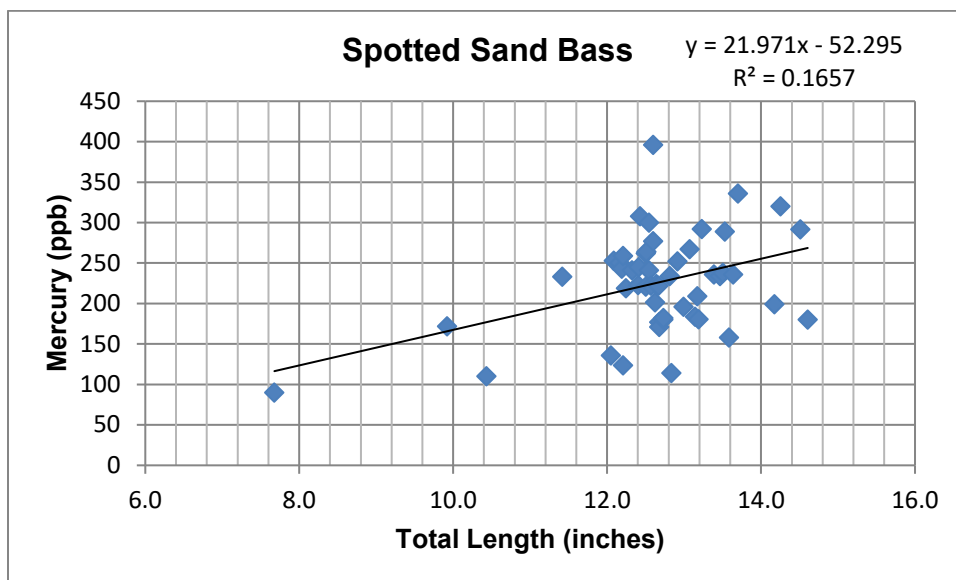
inches in length was a) sufficiently health protective, and b) that it was appropriate to extend this advice to fish measuring 14 inches or longer.

The following excerpt from the OEHHA 2013 San Diego Bay Advisory discusses the rationale for developing advice for the sand bass species. The updated advisory retains the same advice for consumption of the sand bass species:

SPOTTED SAND BASS

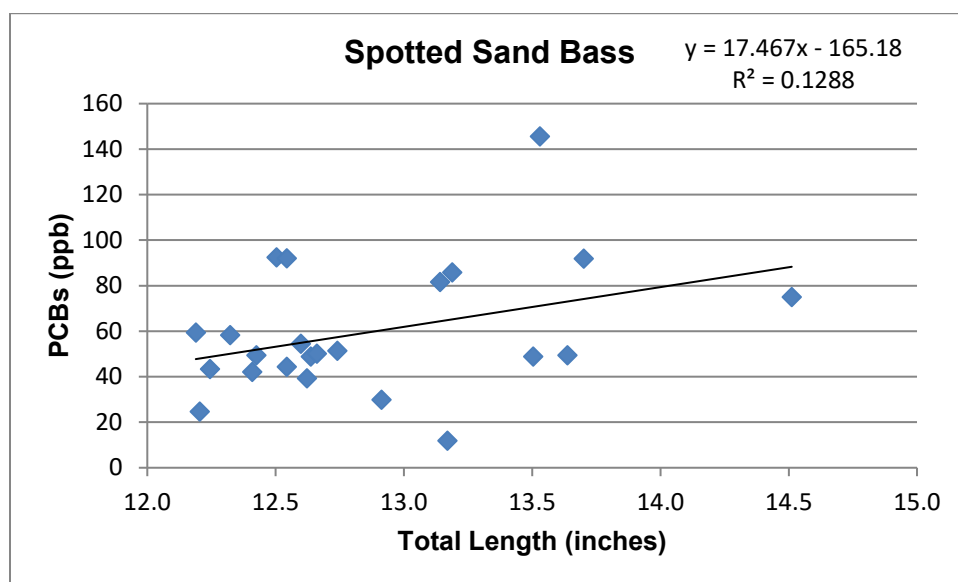
Using data for all sizes collected, OEHHA looked at the relationship between size (total length) and mercury concentrations in spotted sand bass. The results of this regression analysis are shown in Figure 3. The R^2 value (0.17, $p < 0.01$), although significant, indicates that length is not a strong predictor of mercury concentration because it explains only 17 percent of the variance in mercury concentrations. The graph shows that mercury concentrations in samples of spotted sand bass 14 inches and larger are similar to those in spotted sand bass between 12 and 14 inches. OEHHA considered the mean mercury concentration in spotted sand bass 12–14 inches (237 ppb) to be supportive for issuing advice based on the samples that were 14 inches and larger (mean mercury 270 ppb). Both of these mean concentrations correspond to the same advice.

FIGURE 3. RELATIONSHIP BETWEEN LENGTH AND MERCURY CONCENTRATION IN SPOTTED SAND BASS



OEHHA performed a similar analysis for PCBs in spotted sand bass (Figure 4) with similar results. Length is not a strong predictor of PCB concentration ($R^2 = 0.13$, $p > 0.1$). Also, because there was only one sample of legal-sized spotted sand bass greater than or equal to 14 inches (one composite of five fish, mean total length 14.5 inches) analyzed for PCBs, OEHHA compared the results for spotted sand bass 12 to 14 inches to the 14.5-inch sample. The mean concentration of PCBs was 61 ppb for spotted sand bass 12 to 14 inches and 75 ppb for the 14.5-inch sample. Both values correspond to the same advice, 1 serving a week, which is less than that based on mercury. OEHHA considered the mean PCB concentration in spotted sand bass 12–14 inches to be supportive for issuing advice based on the 14.5-inch sample. The recommendation of one serving a week based on PCBs was applied to women over 45 years and men. For the sensitive population, OEHHA reduced the recommendation to no consumption based on the potential additive toxicity of mercury and PCBs to the nervous system.

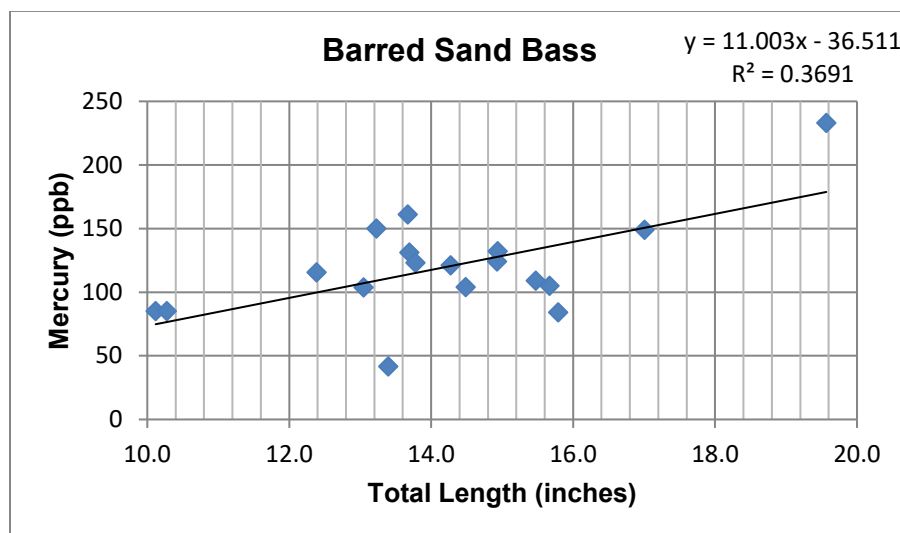
FIGURE 4. RELATIONSHIP BETWEEN LENGTH AND PCB CONCENTRATION IN SPOTTED SAND BASS



BARRED SAND BASS

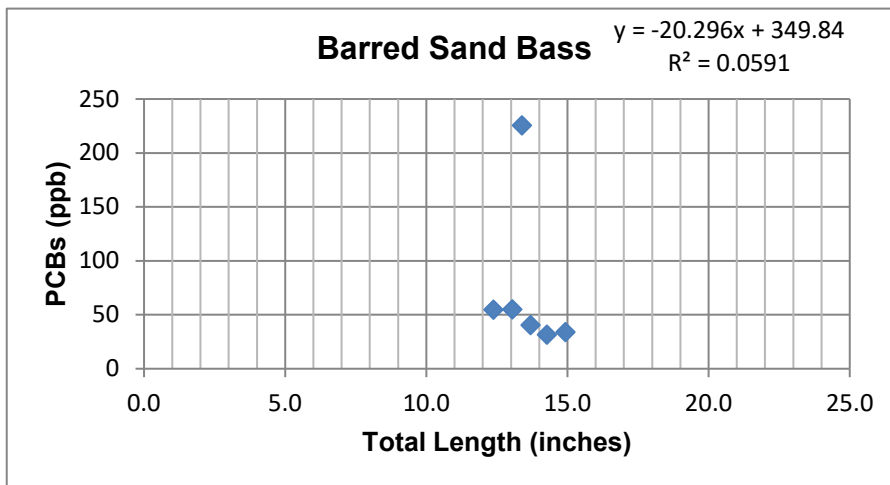
Twenty-one barred sand bass were analyzed for mercury and ten for PCBs. Although the number of samples met OEHHA's criterion, sample size was greatly reduced after omitting samples between 12 inches (the prior legal size) and 14 inches. Regression analysis for mercury in barred sand bass showed that length explained about 37 percent of the variability in mercury concentrations ($R^2 = 0.37$, $p < 0.01$; Figure 5). The mean mercury concentration for barred sand bass 12 to 14 inches was 112 ppb, and for barred sand bass 14 inches and larger, it was 127 ppb. Both means correspond to the same advice.

FIGURE 5. RELATIONSHIP BETWEEN LENGTH AND MERCURY CONCENTRATION IN BARRED SAND BASS



For PCBs, linear regression suggested an inverse relationship between length and concentration (Figure 6). This relationship was trivial, not significant ($R^2 = 0.06$, $p > 0.6$), and based on a small number of samples. Samples of barred sand bass between 12 and 14 inches had higher concentrations of PCBs than samples 14 inches and larger. The mean concentrations were 94 ppb in the smaller bass (12-14 inches) and 33 ppb in the larger barred sand bass (14 inches and larger). Comparison of the mean PCB concentrations to ATLS showed that advice based on PCBs would be fewer servings than advice based on mercury, if the smaller bass were considered, or the same, if the larger bass were used. To be conservative, OEHHA used the mean concentration from all barred sand bass samples 12 inches and larger (73 ppb), which was greater than the mean for barred sand bass 14 inches and larger (33 ppb), to determine the advice. The result was a recommendation of one serving a week for women over 45 years and men. For the sensitive population, the recommendation was reduced to no consumption based on co-exposure to mercury and PCBs.

FIGURE 6. RELATIONSHIP BETWEEN LENGTH AND PCB CONCENTRATION IN BARRED SAND BASS



In sum for barred sand bass and spotted sand bass, PCBs were the main chemical of concern for both populations. For the sensitive population, OEHHA also considered co-exposure to mercury and PCBs. The evaluation led OEHHA to reduce the advice for these two bass species to no consumption. The advice for eating barred sand bass or spotted sand bass for women over 45 years and men is one serving a week.

TABLE 1. FISH SAMPLES EVALUATED FOR THE SAN DIEGO BAY ADVISORY

Common Name	Scientific Name	Number of Samples	Total Number of Fish	Project	Year Collected	Contaminants Analyzed ^a
Flatfish Species						
Diamond Turbot	<i>Hypsopetta guttulata</i>	5	25	CFCP	1999, 2001	Hg
		2	10	CFCP	1999	Chlordanes, DDTs, Dieldrin, Se, Toxaphene
		4	20	CFCP	1999, 2001	PCBs
Spotted Turbot	<i>Pleuronichthys ritteri</i>	6	26	CFCP	2001-2002	Hg, PCBs
		1	5	CFCP	2002	Chlordanes, DDTs, Dieldrin, Se, Toxaphene
Sand Bass Species						
Barred Sand Bass	<i>Paralabrax nebulifer</i>	6	30	CFCP	1999, 2002	Hg, Se
		5	25	CFCP	1999, 2002	Chlordanes, DDTs, Dieldrin, PCBs (2002 only), Toxaphene
		10	18	SWAMP	2009	Hg
		3	15	SWAMP	2009	Se
		1	5	SWAMP	2009	Chlordanes, DDTs, Dieldrin, PCBs
Spotted Sand Bass	<i>Paralabrax maculatofasciatus</i>	25	122	CFCP	1999-2002	Hg
		9	45	CFCP	1999-2002	Se
		21	103	CFCP	1999-2002	PCBs
		9	45	CFCP	1999-2002	Chlordanes, DDTs, Dieldrin, Toxaphene
		1	5	CFCP	2001	PBDEs
		20	36	SWAMP	2009	Hg
		5	25	SWAMP	2009	Se
		1	5	SWAMP	2009	Chlordanes, DDTs, Dieldrin, PCBs

Common Name	Scientific Name	Number of Samples	Total Number of Fish	Project	Year Collected	Contaminants Analyzed ^a
Sharks, Rays, and Skates						
Gray Smoothhound Shark	<i>Mustelus californicus</i>	18	18	CFCP	2002	Hg, Se
		1	5	CFCP	2002	Chlordanes, DDTs, Dieldrin, PCBs, Toxaphene
		2	6	SWAMP	2009	Chlordanes, DDTs, Dieldrin, Hg, PCBs, Se
Leopard Shark	<i>Triakis semifasciata</i>	3	3	CFCP	2002	Hg, Se
		1	1	CFCP	2002	Chlordanes, DDTs, Dieldrin, PCBs, Toxaphene
Round Stingray	<i>Urolophus halleri</i>	13	65	CFCP	2001	Hg, PCBs
Shovelnose Guitarfish	<i>Rhinobatos productus</i>	3	12	CFCP	2002	Chlordanes, DDTs, Dieldrin, Hg, PCBs, Se, Toxaphene
Surfperch Species						
Black Perch	<i>Embiotoca jacksoni</i>	9	42	CFCP	1999, 2001-2002	Hg
		4	19	CFCP	1999, 2002	Se
		5	23	CFCP	2001	DDTs, PCBs
		3	14	CFCP	2002	Chlordanes, Dieldrin, DDTs, PCBs, Toxaphene
Pile Perch	<i>Rhacochilus vacca</i>	3	12	CFCP	2001	Hg, PCBs
Rainbow Surfperch	<i>Hypsurus caryi</i>	1	5	CFCP	2001	Chlordanes, DDTs, Dieldrin, Hg, PCBs, Se, Toxaphene

Common Name	Scientific Name	Number of Samples	Total Number of Fish	Project	Year Collected	Contaminants Analyzed ^a
Shiner Perch	<i>Cymatogaster aggregata</i>	2	19	CFCP	2000-2001	Chlordanes, DDTs, Dieldrin, Hg, PCBs, Se, Toxaphene
		21	42	SWAMP	2009	Hg
		1 ^b	22	SWAMP	2009	Chlordanes, DDTs, Dieldrin, PCBs, Se
Other Species						
Pacific Chub Mackerel	<i>Scomber japonicus</i>	1 ^c	5	CFCP	2001	Hg, PBDEs, Se
		3	24	CFCP	2002	Chlordanes, DDTs, Dieldrin, PCBs, Se, Toxaphene
		2	10	SWAMP	2009	Chlordanes, DDTs, Dieldrin, PCBs, Se
Spiny Lobster	<i>Panulirus interruptus</i>	7	7	RWB9	2014-2015	Hg
		1	4	RWB9	2015	Chlordanes, DDTs, Dieldrin, PCBs, Se
Topsmelt ^b	<i>Atherinops affinis</i>	3	66	CFCP	2002	Chlordanes, DDTs, Dieldrin, Hg, PCBs, Se, Toxaphene
Yellowfin Croaker	<i>Umbrina roncadora</i>	2	8	CFCP	2001-2002	Chlordanes, DDTs, Dieldrin, Hg, PCBs, Se, Toxaphene
		3	15	SWAMP	2009	Hg, Se
		1	5	SWAMP	2009	Chlordanes, DDTs, Dieldrin, PCBs

^aOrganic data (chlordanes, DDTs, dieldrin, PCBs or toxaphene) generated prior to 1999 were excluded from analysis because more recent data are considered more reliable due to improved analytical methods.

^bSamples were analyzed as whole organisms, excluding head, tail, and guts.

^cOnly a single composite sample of five fish met OEHHA's minimum edible length for this species (360 mm). This sample was used to evaluate mercury and selenium levels. Undersized samples were evaluated for organics to develop sufficiently health protective advice.

CHEMICAL CONCENTRATIONS

As shown in Table 1, samples were analyzed for one or more of the following: chlordanes, DDTs, dieldrin, PBDEs, PCBs (46-55 congeners⁴), total mercury, selenium, and toxaphene. Among the chemicals analyzed in fish tissue samples from San Diego Bay, only mercury and PCB levels were sufficiently high to impact consumption advice. In addition, selenium concentrations were only sufficiently high to pose a potential health concern in Spiny Lobster. For this reason, levels of other contaminants are not shown in this report.

All fish samples were prepared as skinless fillets, except for some Shiner Perch samples and all Diamond Turbot, Rainbow Surfperch, and Spotted Turbot Samples, which were prepared as skin-on fillets. Additionally, one composite sample of Shiner Perch and all three composite samples of Topsmelt were analyzed as whole bodies. Samples were analyzed as individual fish or composites.

Composites were prepared from equal amounts of tissue from several similarly sized individual fish of a species. Ideally, for composite samples, the total length of the smallest fish in a composite sample is at least 75% of the length of the largest fish in the sample (US EPA, 2000a). All composite samples from San Diego Bay met this requirement except for one sample of three Spotted Turbot, with the shortest fish measuring at 71% of the longest fish in the composite.

For this advisory, OEHHA used the weighted (by the number of individual fish) arithmetic mean (average) of the chemical concentrations (in wet weight) for each fish species, except Spiny Lobster, to estimate average human exposure. Due to the small number of legal size Spiny Lobster, OEHHA used the 90th percentile value of distribution to develop advice, based on mercury, to ensure that the advice was sufficiently health-protective. Larger lobsters are expected to have higher mercury concentrations.

MERCURY

Samples were analyzed for total mercury, as either individual fish or composite samples, using a direct mercury analyzer (DMA) at the CDFW Moss Landing Marine Laboratories (MLML). The DMA method utilizes thermal decomposition and atomic absorption. OEHHA assumed all mercury detected was methylmercury, which is the most common form found in fish and is also the more toxic form (Bloom, 1992). Table 2 shows the averages and ranges for total length, as well as mercury concentrations in

⁴ Congeners are related compounds with similar chemical forms. Of the 209 possible PCB congeners, 54-55 are generally reported.

each fish species. The DMA method detection limit (MDL)⁵ and the reporting limit (RL)⁶ for total mercury were reported at 4, 12, or 15 (MDL) and 12 or 36 (RL) parts per billion (ppb), respectively. Although mercury was detected at commonly found concentrations in the CFCP study, MDL and RL were not reported for some mercury samples.

PCBS, PBDES, AND PESTICIDES

Some individual and composite samples were analyzed for PCBs, PBDEs, and the legacy pesticides (chlordanes, DDTs, dieldrin, and toxaphene). Pesticides, PBDEs and PCBs were analyzed by gas chromatography at the CDFW Water Pollution Control Laboratory. For chlordanes, DDTs, PCBs, and PBDEs, each of the concentrations presented was the sum of the detected parent compound, congeners, or metabolites, where applicable. Since the MDLs or RLs were relatively low (most levels ≤ 5 ppb with the highest levels reported at 8 ppb and 22 ppb, respectively), individual congeners or metabolites with concentrations reported as non-detects were assumed to be zero. This is a standard method of handling non-detect values for PCBs and other chemicals with multiple congeners or metabolites in a given sample when detection levels are adequate (US EPA, 2000a). Table 3 shows the averages and ranges for total length, as well as PCB concentrations in each fish species.

SELENIUM

The CDFW MLML analyzed species collected from San Diego Bay for selenium, as composite samples, using inductively coupled plasma-mass spectrometry (ICP-MS). The ICP-MS method utilizes desolvation, atomization and ionization with ion separation based on a mass-to-charge ratio to detect the total selenium concentration in a sample. The ICP-MS method detection limit (MDL) and the reporting limit (RL) for total selenium were reported at 100 or 150 and 300 or 400 ppb, respectively. Table 4 shows the averages and ranges for total length, as well as selenium concentrations in each fish species evaluated for selenium.

⁵ The MDL is the lowest quantity of a chemical that can be distinguished (as greater than zero) in a sample.

⁶ The RL is the lowest quantity of a chemical that can be accurately quantified in a sample.

TABLE 2. MERCURY CONCENTRATIONS IN FISH FROM SAN DIEGO BAY

Species from San Diego Bay	Number of Samples	Total Number of Fish	Mean* Total Length (mm) ^c	Range of Total Lengths** (mm)	Concentration in fish (ppb)	
					Mean*	Range**
Flatfish Species						
Diamond Turbot	5	25	206	180-241	22	0-43
Spotted Turbot	6	26	216	150-260	47	23-63
Sand Bass Species						
Barred Sand Bass	16	48	358	310-497	119	42-233
Spotted Sand Bass	45	158	326	305-380	238	114-396
Sharks, Rays, and Skates						
Round Stingray	13	65	301	254-385	278	184-430
Shark group	23	27	746	586-1342	495	221-1925
Gray Smoothhound Shark	20	24	707	586-924	430	221-1041
Leopard Shark	3	3	1062	916-1342	1018	477-1925
Shovelnose Guitarfish	3	12	824	696-976	248	214-267
Surfperch Species						
Black Perch	9	42	242	172-295	99	68-168
Shiner Perch	23	61	130	108-171	51	0-99
Surfperch group^b	4	17	283	241-338	89	28-185
Pile Perch	3	12	297	254-338	114	54-185
Rainbow Surfperch	1	5	249	241-256	28	-
Other Species						
Pacific Chub Mackerel	1	5	381	359-404	155	-
Spiny Lobster	7	7	82	80-87	356 ^a	138-401
Topsmelt	3	66	134	120-150	33	28-40
Yellowfin Croaker	5	23	322	288-379	246	167-375

*Means are an arithmetic average of individual values and/or a weighted average of composites.

**Range of individuals and/or range of the composites.

^aBased on the 90th percentile value and not the arithmetic average (mean = 246 ppb).

^bBased on similar chemical concentration values, Pile Perch and Rainbow Surfperch were combined to form the surfperch group.

^cTotal length is the maximum length of the fish, measured from the tip of the closed mouth to the tip of the pinched tail fin. Round Stingray measurements represent disc width (wing tip to wing tip). For Spiny Lobster, total carapace length was used, measured from the anterior edge to the supracaudal posterior tip.

TABLE 3. PCB CONCENTRATIONS IN FISH FROM SAN DIEGO BAY

Species from San Diego Bay	Number of Samples	Total Number of Fish	Mean* Total Length (mm) ^b	Range of Total Lengths** (mm)	Concentration in fish (ppb)	
					Mean*	Range**
Flatfish Species						
Diamond Turbot	4	20	204	180-239	26	6-70
Spotted Turbot	6	26	216	150-260	12	1-35
Sand Bass Species						
Barred Sand Bass	6	30	346	310-401	73	31-225
Spotted Sand Bass	22	108	327	305-380	62	12-146
Sharks, Rays, and Skates						
Round Stingray	13	65	301	254-385	15	5-23
Shark group	4	12	698	616-916	17	6-41
Gray Smoothhound Shark	3	11	678	616-761	18	9-41
Leopard Shark	1	1	916	-	6	-
Shovelnose Guitarfish	3	12	824	696-976	22	14-31
Surfperch Species						
Black Perch	8	37	246	172-295	37	5-202
Shiner Perch	3	41	136	108-171	161	109-190
Surfperch group^a	4	17	283	241-338	4	3-7
Pile Perch	3	12	297	254-338	3	3-6
Rainbow Surfperch	1	5	249	241-256	7	-
Other Species						
Pacific Chub Mackerel	5	34	297	204-352	89	25-115
Spiny Lobster	1	4	82	80-86	0	-
Topsmelt	3	66	134	120-150	127	109-155
Yellowfin Croaker	3	13	323	288-379	89	84-96

*Means are an arithmetic average of individual values and/or a weighted average of composites.

**Range of individuals and/or range of the composites.

^aBased on similar chemical concentration values, Pile Perch and Rainbow Surfperch were combined to form the surfperch group.

^bTotal length is the maximum length of the fish, measured from the tip of the closed mouth to the tip of the pinched tail fin. Round Stingray measurements represent disc width (wing tip to wing tip). For Spiny Lobster, total carapace length was used, measured from the anterior edge to the supracaudal posterior tip.

TABLE 4. SELENIUM CONCENTRATIONS IN FISH FROM SAN DIEGO BAY

Species from San Diego Bay	Number of Samples	Total Number of Fish	Mean* Total Length (mm) ^a	Range of Total Lengths** (mm)	Concentration in fish (ppb)	
					Mean*	Range**
Flatfish Species						
Diamond Turbot	2	10	218	181-241	339	309-369
Spotted Turbot	1	5	235	210-255	449	-
Sand Bass Species						
Barred Sand Bass	9	45	354	310-428	323	147-780
Spotted Sand Bass	14	70	328	305-380	424	234-810
Sharks and Skates						
Shark group	23	27	746	586-1342	350	99-807
Gray Smoothhound Shark	20	24	707	586-924	367	151-807
Leopard Shark	3	3	1062	916-1342	210	99-345
Shovelnose Guitarfish	3	12	824	696-976	144	113-177
Surfperch Species						
Black Perch	4	19	247	192-295	57	0-218
Shiner Perch	3	41	136	108-171	319	254-352
Rainbow Surfperch	1	5	249	241-256	157	-
Other Species						
Pacific Chub Mackerel	1	5	381	359-404	525	-
Spiny Lobster	1	4	82	80-86	2650	-
Topsmelt	3	66	134	120-150	264	253-278
Yellowfin Croaker	5	23	322	288-379	273	0-380

*Means are an arithmetic average of individual values and/or a weighted average of composites.

**Range of individuals and/or range of the composites.

^aTotal length is the maximum length of the fish, measured from the tip of the closed mouth to the tip of the pinched tail fin. For Spiny Lobster, total carapace length was used, measured from the anterior edge to the supracaudal posterior tip.

DEVELOPMENT OF GUIDELINES FOR EATING FISH FROM SAN DIEGO BAY

The OEHHA fish advisory process considers the health benefits of fish consumption as well as the risk from exposure to the chemical contaminants found in fish. Benefits are included in the advisory process because there is considerable evidence and scientific consensus that fish should be part of a healthy, well-balanced diet. Fish contain many nutrients that are important for general health and, in particular, help promote optimal growth and development of babies and young children, and may reduce the incidence of heart disease in adults (FDA/US EPA, 2017; American Heart Association, 2017;

OEHHA, 2008; Institute of Medicine, 2007; Kris-Etherton et al., 2002). Fish are a significant source of the specific omega-3 fatty acids, docosahexaenoic acid (DHA) and eicosapentaenoic acid (EPA), thought to be associated with these beneficial health effects (USDA/USDHHS, 2015; Weaver et al., 2008).

The 2015-2020 U.S. Dietary Guidelines recommend that 1) the general population “consume eight or more ounces per week (less for young children)” of a variety of seafood⁷ “for the total package of nutrients that seafood provides, including its EPA and DHA content” and 2) “women who are pregnant or breastfeeding should consume at least eight and up to twelve ounces of a variety of seafood per week from choices that are lower in methylmercury” (USDA/USDHHS, 2015). The particular fish that people eat is an important factor in determining the net beneficial effects of fish consumption. For example, studies have shown that children of mothers who ate low-mercury fish during pregnancy scored better on cognitive tests compared to children of mothers who did not eat fish or ate high-mercury fish (Oken et al., 2005 and 2008). Accordingly, because of the high mercury content of certain fish species, the US Food and Drug Administration (FDA) and the US Environmental Protection Agency (US EPA) recommend that women who are pregnant (or might become pregnant) or breastfeeding, and young children avoid consuming shark, swordfish, tilefish (Gulf of Mexico), bigeye tuna, marlin, orange roughy, and king mackerel (FDA/US EPA, 2017).

In order to address the potential health concerns associated with exposure to contaminants in sport fish, OEHHA has established ATLs for chemicals that are known to accumulate in the edible tissues of fish. ATLs consider both the toxicity of the chemical and potential benefits of eating fish. OEHHA uses the ATLs to determine the maximum number of servings per week that consumers can eat, for each species and at each location, to limit their exposure to these contaminants. Consumers can use OEHHA’s guidance when choosing which fish and how much to eat as part of an overall healthy diet.

There are two sets of ATLs for methylmercury in fish because of the age-related toxicity of this chemical (OEHHA, 2008). The fetus and children are more sensitive to the toxic effects of methylmercury. Thus, the ATLs for the sensitive population, including women who might become pregnant (typically 18 to 45 years of age) and children 1-17 years, are lower than those for women 46 years and older, and men 18 years and older. The lower ATL values for the sensitive population provide additional protection to allow for normal growth and development of the brain and nervous system of unborn babies and children. Detailed discussion about the toxicity of common fish contaminants and health benefits of fish consumption, as well as derivation of the ATLs, are provided in “Development of Fish Contaminant Goals and Advisory Tissue Levels for Common

⁷ “Marine animals that live in the sea and in freshwater lakes and rivers. Seafood includes fish, such as salmon, tuna, trout, and tilapia, and shellfish, such as shrimp, crab, and oysters” (USDHHS/USDA, 2015).

Contaminants in California Sport Fish: Chlordane, DDTs, dieldrin, methylmercury, PCBs, selenium, and toxaphene” (OEHHA, 2008) and “Development of Fish Contaminant Goals and Advisory Tissue Levels for Common Contaminants in California Sport Fish: Polybrominated Diphenyl Ethers (PBDEs)” (OEHHA, 2011). A list of the ATLs used in this report is presented in Appendix I.

For each fish species in this advisory, OEHHA compared the mean mercury and PCB concentrations detected in the fillet to the corresponding ATLs to establish the maximum number of servings per week that could be consumed (see Appendix I). For Spiny Lobster, the 90th percentile of the distribution was used to develop consumption advice, based on mercury. A serving size is considered to be 8 ounces, prior to cooking, or about the size and thickness of a hand for fish fillets. Children should be given smaller servings. For smaller fish species, several individuals may be required to yield a serving.

The consumption advice for a fish species is initially based on the chemical with the lowest allowable number of servings per week. Because some chemicals, such as mercury and PCBs, are known to have similar adverse effects, additivity of toxicity is assumed in such cases and may be assessed using multiple chemical exposure methodology (US EPA, 1989 and 2000b). If two or more chemicals with similar adverse effects are present in fish tissue at levels above the corresponding ATL values for daily consumption, multiple chemical exposure methodology is employed. This may result in advising the sensitive population to consume fewer meals per week than would be the case for the presence of one chemical alone, in a similar concentration. The potential effect of multiple chemical exposures (mercury and PCBs) was assessed in all 16 species and affected advice for several species. Concentrations of chlordanes, dieldrin, DDTs, PBDEs, and toxaphene were lower than the corresponding ATL threshold values for daily consumption (OEHHA, 2008 and 2011). These chemicals were therefore not considered further for developing consumption advice and are not shown in Tables 2 through 4.

The average selenium concentration for Spiny Lobster exceeded the minimum ATL threshold value for daily consumption (1000 ppb), so selenium data are shown in Table 4. However, selenium levels did not impact advice for any of the species evaluated. Advice for all species in this advisory was based on mercury or PCB concentrations, or combined exposure to mercury and PCBs that resulted in more restrictive advice for the sensitive population.

OEHHA recommends that individuals strive to meet the US Dietary Guidelines seafood consumption recommendations, while also adhering to federal and OEHHA recommendations to limit the consumption of fish with higher contaminant levels. The advice discussed in the following section represents the maximum recommended number of servings per week for different fish species. People should eat no more than the recommended number of servings for each fish species or species group.

OEHHA's consumption advice for a particular fish species can be extended to other closely related fish species⁸ known to accumulate similar levels of contaminants.

Consumption advice should not be combined. That is, if a person chooses to eat a fish from the "one-serving-a-week" category, then they should not eat any other fish from any source (including commercial) until the next week. If a person chooses to eat a fish from the "two-servings-per-week" category, they can combine fish species from that category, or eat one fish from that category and one from a category that recommends more than two-servings-per-week (if available), for a total of two servings in that week. Then they should not eat any other fish from any source (including commercial) until the following week.

CONSUMPTION ADVICE FOR FISH FROM SAN DIEGO BAY

OEHHA's advisory protocol requires at least nine fish of a species to be collected from a water body before an advisory can be developed for the primary contaminant of concern. This is to ensure the sample dataset is representative of the fish species population in the water body. In some cases, an exception is made for species that are commonly caught and consumed from a given water body but where available data may be limited. For San Diego Bay, the sample size criterion was met for all species or specie groups except Spiny Lobster where there were only seven individuals for mercury and a composite of four individuals for PCBs and selenium. There were not sufficient data to evaluate other species that may be found in this water body.

FLATFISH SPECIES

DIAMOND TURBOT

The mean mercury and PCB concentrations in Diamond Turbot from San Diego Bay were 22 and 26 ppb, respectively. Based on the concentration of PCBs in Diamond Turbot, OEHHA recommends a maximum of two servings a week for the sensitive population (women 18 to 45 years and children 1 to 17 years) and the general population (women 46 years and older, and men 18 years and older).

SPOTTED TURBOT

The mean mercury and PCB concentrations in Spotted Turbot from San Diego Bay were 47 and 12 ppb, respectively. OEHHA would typically recommend a maximum of four servings a week of Spotted Turbot for the sensitive population (women 18 to 45 years and children 1 to 17 years) based on mercury, and a maximum of five servings a week for the general population (women 46 years and older, and men 18 years and older) based on PCBs. However, as many small flatfish species have a similar

⁸ Fish species within the same genus are most closely related, and Family is the next level of relationship.

appearance, identifying individual species may be difficult. To minimize confusion and ease risk communication, OEHHA extends the Diamond Turbot advice for San Diego Bay to the Spotted Turbot. OEHHA recommends a maximum of two servings a week of Spotted Turbot for the sensitive population (women 18 to 45 years and children 1 to 17 years) and the general population (women 46 years and older, and men 18 years and older), based on PCBs.

SAND BASS SPECIES

BARRED SAND BASS

The mean mercury and PCB concentrations in Barred Sand Bass from San Diego Bay were 119 and 73 ppb, respectively. Based on exposure to PCBs, as well as the combined exposure to mercury and PCBs, the advice for the sensitive population (women 18 to 45 years and children 1 to 17 years) would be one serving per week. However, because of the high PCB concentrations in some samples, and the inclusion of some fish that are now considered undersized, OEHHA recommends no consumption of this species by the sensitive population. This is also consistent with advice for this species in the 2013 advisory. OEHHA recommends a maximum of one serving a week of Barred Sand Bass for the general population (women 46 years and older, and men 18 years and older), based on PCBs.

SPOTTED SAND BASS

The mean mercury and PCB concentrations in Spotted Sand Bass from San Diego Bay were 238 and 62 ppb, respectively. Based on the combined exposure to mercury and PCBs, OEHHA recommends no consumption for the sensitive population (women 18 to 45 years and children 1 to 17 years). OEHHA recommends a maximum of one serving a week of Spotted Sand Bass for the general population (women 46 years and older, and men 18 years and older), based on PCBs.

SHARKS, RAYS, AND SKATES

ROUND STINGRAY

The mean mercury and PCB concentrations in Round Stingray from San Diego Bay were 278 and 15 ppb, respectively. Based on mercury, OEHHA recommends a maximum of one serving a week of Round Stingray for the sensitive population (women 18 to 45 years and children 1 to 17 years), and a maximum of two servings a week for the general population (women 46 years and older, and men 18 years and older). PCBs did not impact the advice.

SHARK GROUP (GRAY SMOOTHHOUND SHARK, LEOPARD SHARK)

The mean mercury and PCB concentrations for the combined shark group (Gray Smoothhound Shark, Leopard Shark) from San Diego Bay were 495 ppb and 17 ppb,

respectively. The chemical concentrations for individual species were 430 ppb (Gray Smoothhound Shark) and 1018 ppb (Leopard Shark) for mercury, and 18 ppb (Gray Smoothhound Shark) and 6 ppb (Leopard Shark) for PCBs. Based on mercury in these shark species, OEHHA recommends no consumption for the sensitive population (women 18 to 45 years and children 1 to 17 years), and a maximum of one serving a week of shark for the general population (women 46 years and older, and men 18 years and older). PCBs did not impact the advice.

SHOVELNOSE GUITARFISH

The mean mercury and PCB concentrations in Shovelnose Guitarfish from San Diego Bay were 248 and 22 ppb, respectively. Based on mercury, OEHHA recommends a maximum of one serving a week of Shovelnose Guitarfish for the sensitive population (women 18 to 45 years and children 1 to 17 years), and a maximum of two servings a week for the general population (women 46 years and older, and men 18 years and older), based on mercury or PCBs.

SURFPERCH SPECIES

The initial OEHHA 2013 San Diego Bay Advisory discussed the rationale for developing advice for the surfperch species in noting that many surfperch species can be grouped according to their feeding habits (NOAA, 2007). Shiner Perch feed in the water column, whereas Black Perch, Pile Perch, and Rainbow Surfperch feed in or near sandy or muddy sediments. The non-Shiner Perch species contained much lower levels of PCBs when compared to Shiner Perch. The sample size for Rainbow Surfperch was inadequate to develop specie-specific advice so it was combined with Pile Perch, based on similar contamination levels and feeding styles.

BLACK PERCH

The mean mercury and PCB concentrations in Black Perch from San Diego Bay were 99 and 37 ppb, respectively. Based on the combined exposure to mercury and PCBs, OEHHA recommends a maximum of one serving a week of Black Perch for the sensitive population (women 18 to 45 years and children 1 to 17 years), and a maximum of two servings a week for the general population (women 46 years and older, and men 18 years and older), based on PCBs.

SHINER PERCH

The mean mercury and PCB concentrations in Shiner Perch from San Diego Bay were 51 and 161 ppb, respectively. Based on PCBs, OEHHA recommends no consumption of Shiner Perch for the sensitive population (women 18 to 45 years and children 1 to 17 years) and the general population (women 46 years and older, and men 18 years and older).

SURFPERCH SPECIES GROUP (PILE PERCH, RAINBOW SURFPERCH)

The mean mercury and PCB concentrations for the combined surfperch group (Pile Perch, Rainbow Surfperch) from San Diego Bay were 89 ppb and 4 ppb, respectively. The chemical concentrations for individual species were 114 ppb (Pile Perch) and 28 ppb (Rainbow Surfperch) for mercury, and 3 ppb (Pile Perch) and 7 ppb (Rainbow Surfperch) for PCBs. Based on mercury in these surfperch species, OEHHA recommends a maximum of two servings a week for the sensitive population (women 18 to 45 years and children 1 to 17 years), and a maximum of seven servings a week for the general population (women 46 years and older, and men 18 years and older). PCBs did not impact the advice.

OTHER SPECIES**PACIFIC CHUB MACKEREL**

The mean mercury and PCB concentrations in Pacific Chub Mackerel from San Diego Bay were 155 and 89 ppb, respectively. Based on the combined exposure to mercury and PCBs, OEHHA recommends no consumption of Pacific Chub Mackerel for the sensitive population (women 18 to 45 years and children 1 to 17 years), and a maximum of one serving a week for the general population (women 46 years and older, and men 18 years and older), based on PCBs.

SPINY LOBSTER

The 90th percentile of the distribution mercury value and mean PCB concentrations in Spiny Lobster from San Diego Bay were 356 and 0 ppb, respectively. Based on mercury, OEHHA recommends a maximum of one serving a week of Spiny Lobster for the sensitive population (women 18 to 45 years and children 1 to 17 years), and a maximum of two servings a week for the general population (women 46 years and older, and men 18 years and older). PCBs and selenium did not impact the advice.

TOPSMELT

The mean mercury and PCB concentrations in Topsmelt from San Diego Bay were 33 and 127 ppb, respectively. Based on PCBs, OEHHA recommends no consumption of Topsmelt for the sensitive population (women 18 to 45 years and children 1 to 17 years) and the general population (women 46 years and older, and men 18 years and older).

YELLOWFIN CROAKER

The mean mercury and PCB concentrations in Yellowfin Croaker from San Diego Bay were 246 and 89 ppb, respectively. Based on the combined exposure to mercury and PCBs, OEHHA recommends no consumption of Yellowfin Croaker for the sensitive population (women 18 to 45 years and children 1 to 17 years), and a maximum of one

servicing a week for the general population (women 46 years and older, and men 18 years and older), based on PCBs.

CHANGES FROM THE 2013 ADVISORY

This update includes the following changes and additions from the original 2013 San Diego Advisory:

- 1) Consumption advice for Spiny Lobster was added to the advisory, based on data from samples collected by the San Diego Regional Water Quality Control Board in 2014-15.
- 2) California Lizardfish advice was removed because all samples were below the minimum edible length of 305 millimeters (mm). The previous 2013 advice of two meals per week for this species was based on PCB concentrations. After the original 2013 advisory, OEHHA determined minimum edible lengths for California Lizardfish and several other fish species for which there is not a legal minimum length. OEHHA determined the minimum edible length for California Lizardfish to be 305 mm, based on the smallest total length at which half of that species typically achieves sexual maturity. All California Lizardfish samples used in the original San Diego Bay advisory were taken in 2001 and 2002, and ranged from 206 to 297 mm in length. Because larger fish are typically older and contaminants tend to accumulate in fish over their lifetime, advice based on the analysis of undersized fish may not be sufficiently health protective, and may therefore provide a false sense of security for individuals consuming full-sized California Lizardfish. Because sampling data on this species is very limited, OEHHA does not believe it can provide reliable consumption advice and therefore removed California Lizardfish from the updated advisory.
- 3) Pacific Chub Mackerel advice changed for the sensitive population. Subsequent to the original 2013 advisory, OEHHA calculated a minimum edible length of 360 mm for Pacific Chub Mackerel (see the discussion on California Lizardfish in the previous paragraph). OEHHA revised its consumption advice based, in part, on mercury data only from those samples that met the minimum edible length of 360 mm. This resulted in more health protective advice for the sensitive population (i.e. do not eat), compared to the one meal a week advice developed for Pacific Chub Mackerel in the 2013 advisory.
- 4) Black Perch advice changed for the sensitive population, while Pile Perch and Rainbow Surfperch advice changed for the general population. Multiple surfperch species (Black, Pile, Rainbow) from San Diego Bay with similar feeding habits (e.g. sandy or muddy sediment) had comparable chemical concentrations for mercury and PCBs. To simplify risk communication, the original advisory developed consumption advice for these species as a group, rather than provide species-specific advice. This update provides species-specific advice, when different from other surfperch species, resulting in more health protective advice

for the sensitive population for Black Perch, and increased consumption advice for the general population for Pile Perch and Rainbow Surfperch from San Diego Bay.

RECOMMENDED MAXIMUM NUMBER OF SERVINGS

The recommended maximum numbers of servings per week for fish from San Diego Bay are shown in Table 5.

TABLE 5. RECOMMENDED MAXIMUM NUMBER OF SERVINGS PER WEEK FOR FISH FROM SAN DIEGO BAY

Fish Species from San Diego Bay	Women 18–45 years and Children 1-17 years	Women 46 years and older and Men 18 years and older
Flatfish Species		
Diamond Turbot	2	2
Spotted Turbot	2	2
Sand Bass Species		
Barred Sand Bass	0	1
Spotted Sand Bass	0	1
Sharks, Rays, and Skates		
Sharks	0	1
Round Stingray	1	2
Shovelnose Guitarfish	1	2
Surfperch Species		
Black Perch	1	2
Pile Perch	2	7
Rainbow Surfperch	2	7
Shiner Perch	0	0
Other Species		
Pacific Chub Mackerel	0	1
Spiny Lobster	1	2
Topsmelt	0	0
Yellowfin Croaker	0	1

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APPENDIX I. ADVISORY TISSUE LEVELS

Advisory Tissue Levels (ATLs) guide the development of advice for people eating sport fish. ATLs are levels of contaminants found in fish that correspond to the maximum numbers of recommended fish servings. OEHHA uses ATLs to provide advice to prevent consumers from being exposed to:

- More than the average daily reference dose⁹ for chemicals not known to cause cancer, such as methylmercury, or
- For cancer-causing chemicals, a risk level greater than one additional cancer case in a population of 10,000 people consuming fish at the given consumption rate over a lifetime. This cancer endpoint is the maximum acceptable risk level recommended by the US EPA (2000b) for fish advisories.

For each chemical, ATLs were determined for both cancer and non-cancer risk, if appropriate, for one to seven eight-ounce servings per week. The most health-protective ATLs for each chemical, selected from either cancer or non-cancer based risk, are shown in the table below for zero to seven servings per week. When the guidelines for eating fish from San Diego Bay are followed, exposure to chemicals in fish from San Diego Bay would be at or below the average daily reference dose or the cancer risk probability of one in 10,000.

ADVISORY TISSUE LEVELS FOR SELECTED ANALYTES

Contaminant	Consumption Frequency Categories (8-ounce servings/week) ^a and ATLs (in ppb)							
	7	6	5	4	3	2	1	0
Chlordanes	≤ 80	>80-90	>90-110	>110-140	>140-190	>190-280	>280-560	>560
DDTs	≤ 220	>220-260	>260-310	>310-390	>390-520	>520-1,000	>1,000-2,100	>2,100
Dieldrin	≤ 7	>7-8	>8-9	>9-11	>11-15	>15-23	>23-46	>46
MeHg (Women 18-45 and children 1-17)	≤ 31	>31-36	>36-44	>44-55	>55-70	>70-150	>150-440	>440
MeHg (Women > 45 and men)	≤ 94	>94-109	>109-130	>130-160	>160-220	>220-440	>440-1,310	>1,310
PBDEs	≤ 45	>45-52	>52-63	>63-78	>78-100	>100-210	>210-630	>630
PCBs	≤ 9	>9-10	>10-13	>13-16	>16-21	>21-42	>42-120	>120
Selenium	≤ 1000	>1,000-1200	>1,200-1,400	>1,400-1,800	>1,800-2,500	>2,500-4,900	>4,900-15,000	>15,000
Toxaphene	≤ 87	>87-100	>100-120	>120-150	>150-200	>200-300	>300-610	>610

^a Serving sizes (prior to cooking, wet weight) are based on an average 160-pound person. Individuals weighing less than 160 pounds should eat proportionately smaller amounts.

⁹ The reference dose is an estimate of the maximum daily exposure to a chemical likely to be without significant risk of harmful health effects during a lifetime.