HEALTH ADVISORY AND SAFE EATING GUIDELINES FOR FISH FROM COASTAL AREAS OF SOUTHERN CALIFORNIA: VENTURA HARBOR TO SAN MATEO POINT

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Health Advisory
and
Safe Eating Guidelines
for Fish from
Coastal Areas of Southern California:
Ventura Harbor to San Mateo Point

June 2009

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FOREWORD

This report provides guidelines for consumption of various fish species taken from coastal waters of southern California from Ventura Harbor to San Mateo Point. This report is a revision of a previous state advisory for the Southern California coast from Point Dume to Dana Point. These guidelines were developed as a result of studies of PCB, DDT, and mercury concentrations in fish tested from these water bodies, and are provided to fish consumers to assist them in making choices about the types of fish and frequency of consumption considered safe to eat. Some fish tested from these water bodies showed high contaminant levels and guidelines are provided to protect against possible adverse health effects from contaminated fish. Additionally, the guidelines provide information to aid consumers in selecting fish that are lower in contaminants. This report provides background information and a description of the data and criteria used to develop the guidelines.

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EXECUTIVE SUMMARY

A total of 1,373 fish from 22 species or species groups were collected along the coastal waters of southern California from Ventura Harbor in Ventura County to San Mateo Point in Orange County. Fish were analyzed for one or more of the contaminants PCBs (polychlorinated biphenyls), DDTs (dichlorodiphenyltrichloroethane and its metabolites), chlordane, dieldrin, and mercury. The Office of Environmental Health Hazard Assessment (OEHHA) evaluated the contaminant data to determine whether harmful health effects might occur if certain sport fish from these areas were eaten regularly.

Based on this evaluation, OEHHA developed a health advisory and safe eating guidelines for fish from this area. The advisory warns fishers against eating specific species from some or all locations. The safe eating guidelines identify fish species with low contaminant levels that are safe to eat frequently (once a week or more). Evaluating contaminants that may be found in fish is OEHHA's primary concern, but OEHHA also wants its advisories to reflect the general scientific agreement that eating fish appears to promote significant health benefits, including decreased mortality. These potential benefits are thought to occur because of unique omega-3 fatty acids found in fish. The benefits include decreased rates of cardiovascular disease and stroke, decreased inflammation, and improvements in brain and visual function. Fish consumption during pregnancy has been associated with higher cognitive scores in young children. The health advisory and safe eating guidelines give consumers information to make healthy choices in fish consumption.

Sufficient numbers of fish were collected to provide consumption advice for barracuda, barred sand bass, black croaker, corbina, California halibut, California scorpionfish (also known as "sculpin"), jacksmelt, kelp bass, opaleye, Pacific chub mackerel, queenfish, rockfishes, sardines, sargo, shovelnose guitarfish, surfperches, topsmelt, white croaker (also known as "tomcod" and "kingfish"), and yellowfin croaker. Because sport fish were collected from such a large geographic area, OEHHA divided the advisory and safe eating guidelines into regions based on highly variable contaminant levels found in some species: 1) Ventura Harbor to Santa Monica Pier, 2) Santa Monica Beach south of Santa Monica Pier to Seal Beach Pier, and 3) South of Seal Beach Pier to San Mateo Point. Contaminant levels were very similar in the first (northern) and third (southern) regions and, thus, the consumption advice provided for these two areas is identical. See the following map and tables for fish consumption advice for each of the regions. For fish species and regions where the potential health effects resulting from exposure to PCBs were low relative to those from mercury, the consumption advice for women 18-45 years and children 1-17 years is more restrictive than for women over 45 years and men. This is because the fetus and children are more sensitive to the toxic effects of the form of mercury found in fish (methylmercury).

This study also found that PCB levels in some fish caught in this area were far higher in skin-on fillets than in fillets where the skin had been removed. Consumption advice is based on contaminant levels in skin-off fillets. OEHHA strongly advises fishers only to eat the safest part of the fish, skin-off fillets.

This effort revises a previous state advisory for the area using new data and improved analytical methods. Of the above species, sardines, sargo, shovelnose guitarfish, topsmelt, and yellowfin croaker were not included in the previous advisory.

For general advice on how to limit your exposure to chemical contaminants in sport fish (e.g., eating smaller fish of legal size), and to see a factsheet on methylmercury and PCBs in sport fish, see the California Sport Fish Consumption Advisories (http://www.oehha.ca.gov/fish.html). Guidelines for other California water bodies can be found online at: http://www.oehha.ca.gov/fish/so_cal/index.html.

Unlike the case for DDTs and PCBs, various cooking and cleaning techniques will not reduce the methylmercury content of fish. Additionally, there are no known ways to prepare fish (such as soaking in milk) that will reduce the methylmercury content of the fish.

A guide to eating fish caught from Ventura Harbor to San Mateo Point

Women 18 - 45, especially those who are pregnant or breastfeeding, and children 1 - 17

	Yellow Zone (see map)	Red Zone (see map)
Jacksmelt	Safe to eat 4 servings per week	Safe to eat 4 servings per week
	OR	OR
Corbina, Pacific chub mackerel, Yellowfin croaker, Queenfish, Surfperches, Opaleye	2 servings per week	2 servings per week
	OR	OR
California halibut, Sargo, Rockfishes, Kelp bass (Calico bass), California scorpionfish (Sculpin), Sardines, Shovelnose guitarfish	1 serving per week	1 serving per week
	OR	
Topsmelt	2 servings per week	DO NOT EAT
	OR	
Barred sand bass, White croaker (Kingfish or Tomcod)	1 serving per week	DO NOT EAT
Barracuda, Black croaker	DO NOT EAT	DO NOT EAT

For example: If you eat 1 serving of Kelp bass, do not eat any more fish until the next week.

Office of Environmental Health Hazard Assessment
www.oehha.ca.gov/fish.html

A guide to eating fish caught from Ventura Harbor to San Mateo Point

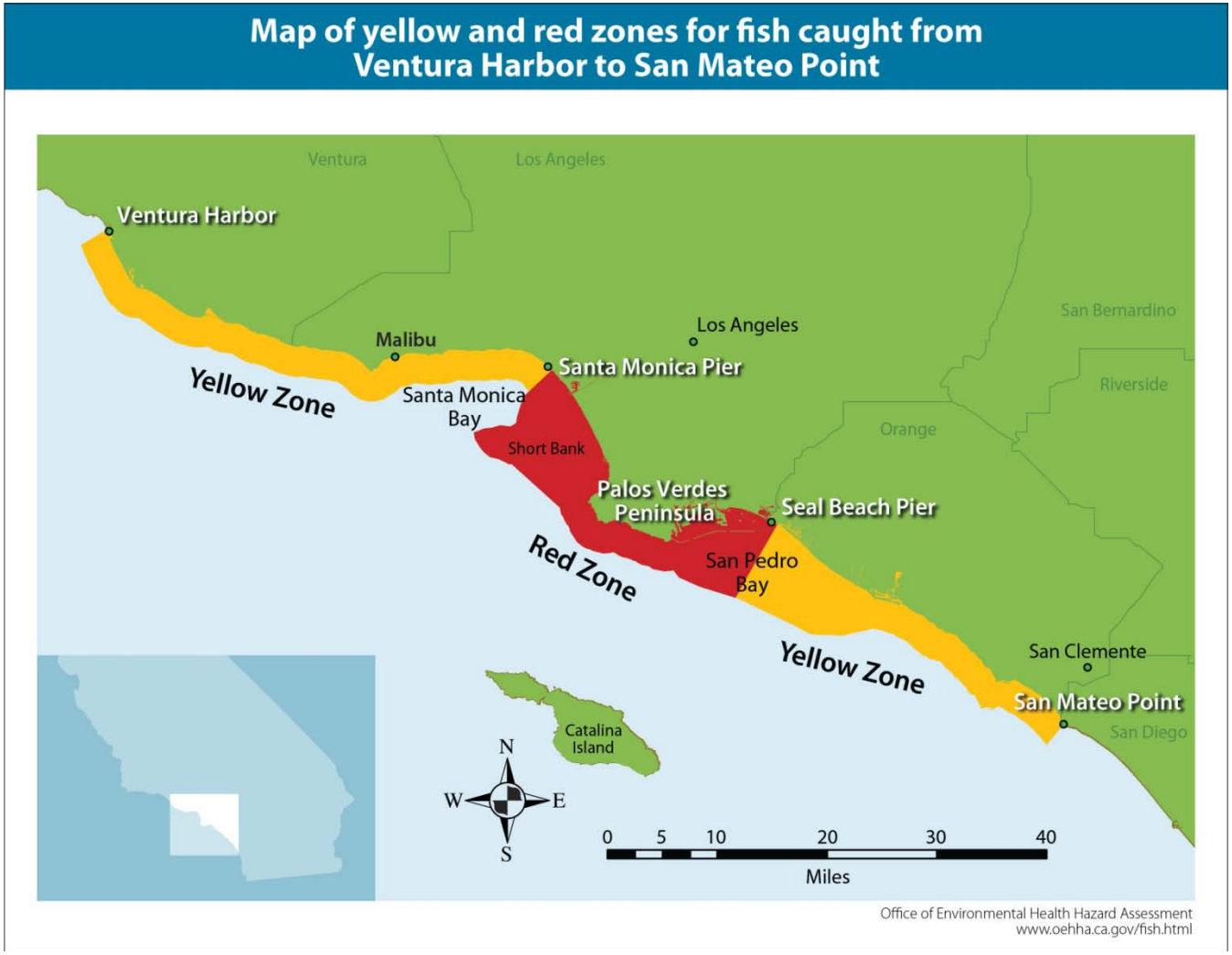
Women over 45 years and men over 17 years

	Yellow Zone (see map)	Red Zone (see map)
Jacksmelt	Safe to eat 7 servings per week	Safe to eat 7 servings per week
	OR	OR
Pacific chub mackerel	4 servings per week	4 servings per week
	OR	OR
California halibut, Queenfish, Surfperches, Opaleye, Rockfishes, Corbina, Yellowfin croaker, Shovelnose guitarfish	2 servings per week	2 servings per week
	OR	OR
Sardines, Black croaker, Sargo, Barracuda, California scorpionfish (Sculpin), Kelp bass (Calico bass)	1 serving per week	1 serving per week
	OR	
Barred sand bass, Topsmelt, White croaker (Kingfish or Tomcod)	2 servings per week	DO NOT EAT

For example: If you eat 1 serving of Kelp bass, do not eat any more fish until the next week.

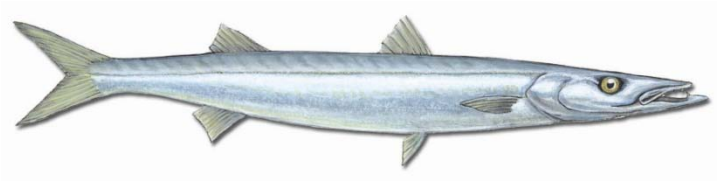
Office of Environmental Health Hazard Assessment
www.oehha.ca.gov/fish.html

Health Advisory and Safe Eating Guideline Regions



FISH IMAGES
(not to scale)

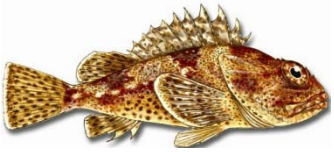
Barred Sand Bass



Barracuda

Black croaker

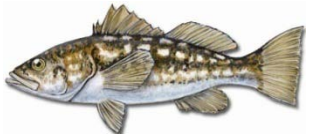
California halibut



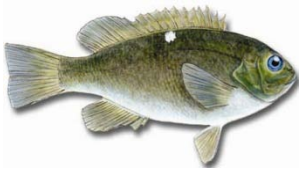
California scorpionfish

Corbina

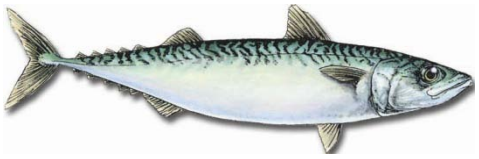
Jacksmelt



Kelp bass

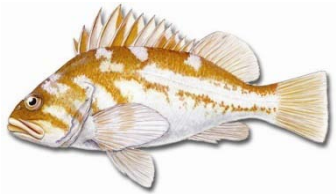


Opaleye



Pacific chub mackerel

Queenfish



Rockfishes (the advisory includes all rockfish species)

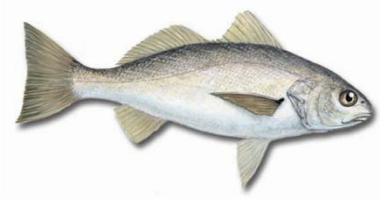
Sardine

Sargo

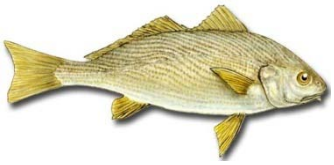
Shovelnose guitarfish

Surfperches (the advisory includes all surfperch species)

Topsmelt



White croaker



Yellowfin croaker

INTRODUCTION

Chemical contamination of ocean waters, sediments and seafood along the southern California coast originates from many sources, including municipal wastewater, urban and agricultural runoff, industrial discharges, vessel discharges, aerial fallout, and hazardous materials spills (Bay et al., 2003; Schiff, 2000; Schiff et al., 2000). Of the pollutants entering these waters, those considered to pose the greatest potential health risk associated with seafood consumption include the chlorinated hydrocarbons dichlorodiphenyltrichloroethane and its metabolites (DDTs) and polychlorinated biphenyls (PCBs) (Schiff et al., 2000). For at least two decades prior to the early 1970s, DDTs and PCBs were freely discharged by several industries into the Los Angeles County sewer system (MSRP and U.S. EPA, 2007). Millions of pounds of these contaminants were deposited onto the ocean floor of the Palos Verdes Shelf, off the Palos Verdes Peninsula, via submarine outfalls of the Joint Water Pollution Control Plant (CH2M HILL, 2007; Lee et al., 2002; Schafer, 1989; Stull, 1995; Stull et al., 1996; Young et al., 1976). After the discovery of contamination in offshore sediments, additional studies showed that DDTs and PCBs were also greatly elevated in some marine fish near Los Angeles (MacGregor, 1974; Smokler, 1979; Young et al., 1975; 1976; 1977). For example, in a 1971-1972 survey, between 47 and 76 percent of Dover sole, black perch and kelp bass collected from the Palos Verdes shelf exceeded the U.S. Food and Drug Administration (FDA) action level of 5 parts per million (ppm) for total DDTs. DDT levels in fish and crabs were often 100-fold higher than in the same species from nearby uncontaminated coastal areas (Young et al., 1976).

In response to initial data showing DDT and PCB contamination in area fish, interim sport fish consumption guidelines were issued in 1985 by the California Department of Health Services (see Pollock et al., 1991). Since 1991, the Office of Environmental Health Hazard Assessment (OEHHA) has been the agency responsible for evaluating potential public health risks from chemical contamination of sport fish. This includes issuing 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, and Section 59011, to advise local health authorities, and the California Water Code Section 13177.5, to issue health advisories. The 1985 interim guidelines suggested that consumers avoid eating white croaker from the Santa Monica Bay-Palos Verdes Peninsula area and limit consumption of other local sport fish in this region to one meal per month for women and young children and one to two meals per week or less for other individuals. In 1990, the California Department of Fish and Game prohibited commercial fishing for white croaker from waters near the Palos Verdes shelf. Following additional collection and analysis of 15 fish species at 24 sites, OEHHA issued a more detailed fish consumption advisory for the Los Angeles/Orange County coastal area that was based on DDTs, PCBs, and mercury (Pollock et al., 1991). In that advisory, consumption restrictions were also recommended for black croaker, corbina, kelp bass, queenfish, rockfishes, surfperches, and sculpin at one or more of 11 specific sites.

Although DDTs and PCBs were banned from use in the United States in the early 1970s, substantial quantities of these contaminants remain partially buried on the Palos Verdes Shelf in a sediment layer covering more than 40 square kilometers (Eganhouse and Pontolillo, 2008; Lee et al., 2002; NOAA, 1991; Niedoroda et al., 1996). DDTs and PCBs in sediments continue to pose a risk to the local marine environment through their remobilization into the water column by various biological and physical processes (Stull et al., 1996; Zeng and Venkatesan, 1999). Since the 1991 advisory, continuing efforts have been made to examine chemical contaminants in fish

from southern California coastal waters. The most extensive study resulted from a legal settlement between the state and federal governments and several parties involved in the discharge of DDTs and PCBs. The settlement funded efforts by six federal and state agencies to assess human health and ecological risks and to restore injured natural resources in the area and is known as the Montrose Settlements Restoration Program (MSRP) (MSRP and U.S. EPA, 2007). The fish consumption recommendations included herein are based on data collected by MSRP and U.S. Environmental Protection Agency (U.S. EPA). In addition to DDTs and PCBs, mercury, chlordane, and dieldrin were analyzed in collected fish to determine whether contaminants not included in the settlement might also pose significant health risks for frequent fish consumers or affect various restoration activities (MSRP and U.S. EPA, 2007).

Fish advisories developed by OEHHA are published in the California Sport Fishing Regulations and California Sport Fish Consumption Advisories. Although evaluating contaminants that may be found in fish is be of primary concern, OEHHA has also determined that there is a significant body of evidence and general scientific consensus that eating fish at dietary levels that are readily achievable, but well above national average consumption rates, appears to promote significant health benefits, including decreased mortality. These potential beneficial effects are thought to stem largely from unique omega-3 fatty acids found in fish (docosahexaenoic acid or DHA and eicosapentaenoic acid or EPA) and include reduced rates of cardiovascular disease and stroke, decreased inflammation, and improvements in cognitive and visual function. Fish consumption during pregnancy, in particular, has been associated with higher cognitive scores in young children. In order to take these benefits into account and best promote the overall health of the fish consumer, OEHHA has expanded the advisory process beyond a simple identification of risks from chemical contaminants (see Klasing and Brodberg [2008] for more discussion on risks and benefits of fish consumption). OEHHA now emphasizes “safe eating guidelines” as part of health advisories in an effort to inform consumers of healthy choices in fish consumption as well as those that should be avoided or restricted. OEHHA encourages people of all ages, especially women of childbearing age (18-45 years) and children, to select and eat fish that are low in mercury or other contaminants and high in omega-3 fatty acids (DHA and EPA).

DATA COLLECTION

Data used for this evaluation were obtained primarily from the 2002-2004 Southern California Coastal Marine Fish Contaminants Survey (MSRP and U.S. EPA, 2007), which included some data collected by the Los Angeles County Sanitation District (LACSD). In addition, data from the Coastal Fish Contamination Program (CFCP) of the State Water Resources Control Board (SWRCB) were examined to provide support for conclusions drawn from evaluation of the MSRP/EPA data or to add additional species to the advisory, if appropriate. A detailed discussion of the MSRP/EPA study can be found in MSRP and U.S. EPA (2007); a brief description summarized from that report follows.

Fish were collected along the southern California coastline in three counties (Ventura, Los Angeles, and Orange) from just north of Ventura Harbor to San Mateo Point (see Figure 1). Because sufficient barracuda samples were not collected within the planned sampling region, the original southern boundary was expanded from Dana Point to San Mateo Point. There were 24 collection segments in a roughly north-to-south orientation (segment 13-14 was considered one

segment), with an additional seven U.S. EPA sites in and around the Palos Verdes area (including "A inside" and "A outside" of the Los Angeles/Long Beach Harbor breakwater). Sampling at U.S. EPA sites was intended to determine the sufficiency of the current commercial white croaker catch ban area. Segment descriptions, species collected and sample sizes for each segment are presented in Table 1.

A total of 1,373 fish comprising 22 species or species groups were analyzed for one or more contaminants. Fish were collected in pre-determined target lengths to align with expected normal angler catch. The organochlorine compounds PCBs, DDTs, chlordane, and dieldrin were analyzed by gas chromatography/mass spectrometry with selective ion monitoring (GC/MS-SIM), usually on individual skinless fillets, although a few species considered unlikely to show regional differences were analyzed as composites. Pacific sardines, jacksmelt, and topsmelt were analyzed as whole fish (including viscera). Organochlorine analyses were also conducted on an additional subset of white croaker (bottom feeder) and kelp bass (water-column feeder) samples as whole body parts to estimate contaminant concentrations for different possible consumption scenarios (e.g., whole fish or skin-on fillets). PCBs were calculated as the sum of 45 congeners analyzed, while DDTs were calculated as the sum of *p,p'*-DDT, *o,p'*-DDT, *p,p'*-DDE, *o,p'*-DDE, *p,p'*-DDD, and *o,p'*-DDD. *Cis/trans* chlordane, oxychlordane, and *cis/trans* nonaclor were summed to determine total chlordane. Mercury was analyzed as total mercury by cold vapor atomic absorption spectroscopy on composites of 10 fish, unless results for a species indicated that site may have influenced concentration, in which case they were analyzed as individuals. In most cases, more than 95% of mercury in fish occurs as the highly toxic form methylmercury. A conservative assumption was made that all measured mercury was methylmercury. For ease of communication, the term "mercury" will be used in this report to refer to concentrations of the metal measured in fish as well as the health effects that result from methylmercury exposure.

Mean PCB, DDT, and mercury concentrations, fish lengths, segments at which each species were collected, and total number of fish analyzed for each species are presented in Table 2. Chemical concentrations are reported in wet weight. Arithmetic means, rather than geometric means, were used to represent the central tendency (average) of mercury concentrations for all species in this report. In general, arithmetic means for environmental chemical exposures are more health-protective than geometric means, and are commonly used in human health risk assessments. Grand means for each chemical were calculated as the average of segment means. Concentrations of chlordane and dieldrin were below levels of concern (see Klasing and Brodberg, 2008) and will not be addressed in this report.

DATA EVALUATION

As a first step in interpreting contaminant levels in fish, OEHHA has developed advisory tissue levels (ATLs) for PCBs, DDTs, methylmercury, and other contaminants found in fish (Klasing and Brodberg, 2008) similar to risk-based consumption limits recommended by U.S. EPA (2000). ATLs relate the number and size of recommended fish meals to contaminant concentrations found in fish (Table 3). These values were designed so that individuals consuming no more than a preset number of meals should not exceed the reference dose (RfD) for non-cancer hazards associated with chemical contaminants, on average, or a risk level of $1x10^{-4}$ for carcinogens (no more than one additional case of cancer for every 10,000 people exposed over a lifetime). ATLs for methylmercury for women over 45 years and men are approximately three times higher than for sensitive populations because of the three-fold higher RfD used for this

population group. The sensitive population is defined as women of childbearing age (18-45 years), including women who are pregnant or breastfeeding, and children aged 1-17 years. Meal sizes were based on a standard eight-ounce (227 grams) portion of uncooked fish, which is approximately six ounces after cooking, for adults who weigh roughly 70 kilograms (equivalent to 154 pounds). OEHHA recommends that people who weigh less than 70 kilograms eat smaller portions of fish and, in particular, children up to age 12 eat about half as much. A description of the process of developing ATLs, including toxicological information on PCBs, DDTs and methylmercury, can be found in Klasing and Brodberg (2008).

Because numerous fish species were collected from a large geographic area, and because known point sources of PCB and DDT contamination in the area may have led to highly variable tissue contaminant levels across segments, it was important to develop a systematic approach to examining the data. First, data for each species were evaluated to determine what consumption advice would be given at each segment for each chemical, based solely on the ATLs. Special attention was paid to species that exceeded the "do not consume" threshold for any chemical at any segment. The "risk driver" (i.e., the contaminant eliciting the most restrictive consumption advice) for each species at each segment was thus identified. Next, species that had highly variable contaminant levels within or among segments were evaluated to determine the possible causes for such variability. In some cases, statistical analyses were performed to determine the effect of site, lipid content or fish length on tissue contaminant levels (see below). Ease of risk communication was also taken into account. In cases where there was significant variation among neighboring segments, data might be "smoothed" such that the average or most health protective advice was recommended across those segments, as appropriate. Sample size and known areas of contamination were considered in this process. A single high segment mean (particularly if based on low sample size) would likely be averaged with surrounding areas, whereas the most health protective advice would be considered if multiple high values were found across multiple segments even if the overall mean resulted in less restrictive advice. If a single high or very high segment mean was identified in a known area of contamination, the most restrictive advice might be expanded across the entire contaminated zone rather than recommending consumption advice based on the average contaminant level. After all data were examined in this manner, fish were placed into one of two categories: those species for which different consumption advice would be recommended for different segments and those for which uniform consumption advice would be recommended for the entire area. Consumption advice would also be based on population group within these categories if mercury concentrations were high enough to affect advice. For each species, the potential effects of multiple chemical exposures were considered before consumption advice was finalized. A description of the data for each species follows.

Fish with Site-related Differences:

<u>White croaker:</u>

A total of 349 white croaker were collected from 25 segments in Ventura Harbor, Los Angeles and Orange counties. The overall mean PCB, DDT and mercury concentrations were 91, 549 and 108 ppb, respectively. As expected based on historical data, PCB and DDT concentrations were considerably elevated at several segments, particularly near the Palos Verdes peninsula and segment 5 (see discussion about segment 5 below). Because of these differences, OEHHA determined that regional consumption advice should be issued for white croaker.

Using the ATL table and examining the MSRP/EPA data, mean PCB levels in white croaker exceeded the "do not consume" cutoff (>120 ppb) at five non-contiguous segments (5, 12, 15, 24, and EPA B) and approached this cutoff (>90 ppb) at another six segments (13-14, 16, 17, 18, 23, and EPA E). The "do not consume" cutoff for DDTs (>2,100 ppb) was exceeded at two segments (15 and 24). Additionally, 2002 and 2005 LACSD data collected from three zones around the Palos Verdes peninsula and reported in MSRP/EPA (2007) showed that DDTs and PCBs in white croaker exceeded the "do not consume" cutoff at two and three of these zones, respectively. Figure 2 shows PCB concentrations in white croaker from the coastal area bounded by these segments (segment 5 south to the Orange County line) and includes 2002, 2004 and 2005 LACSD data (CSDLAC, 2006).

PCB data from segment 5 deserves special discussion. In addition to white croaker, PCB concentrations were also high in topsmelt at segment 5 (182 and 215 ppb for the two species, respectively; see topsmelt discussion below). In both species, lipid concentrations in fish at this segment were noticeably elevated compared to other segments (7.29% and 4.86% for topsmelt and white croaker, respectively, analyzed as total extractable organics). Statistical evaluation was possible for the six species collected at segment 5 that were analyzed as individuals (white croaker, surfperches, California halibut, California scorpionfish, opaleye, and topsmelt). Lipid levels were higher at segment 5 than for any other segment for four of these six species and the second highest of any segment for one of the six species. For all six species, PCB concentrations were significantly and positively correlated with lipid content across all segments ($p \leq 0.02$; adjusted $r^2 = 0.20\text{-}0.73$). Thus, higher fat fish of these species would be expected to contain higher levels of PCBs. It is not known why fish from segment 5 had higher lipid concentrations than expected, or whether this was a transient effect; however, OEHHA considered it prudent to include segment 5 with the other non-contiguous segments that had high levels of PCBs in white croaker.

One of the primary considerations when issuing fish consumption advisories is risk communication. If advisories are too complex, e.g., advice changes from pier to pier in the same coastal region, fishers may have trouble understanding or following the recommendations. For this reason, and using best professional judgment, some "smoothing" of advice across multiple contiguous sites was done. As noted above, "do not consume" segments for white croaker, based on PCBs or PCBs and DDTs, ranged geographically from segment 5 in the north to segment 24 in the south. With the exception of segments 6, 7, and EPA A, all other MSRP/EPA segments where white croaker were collected within this area neared or exceeded the "do not consume" cutoff (EPA C and D were considered outside this geographic area). The mean PCB concentration of these segments using only MSRP/EPA data was 128 ppb; incorporating LACSD data for the Palos Verdes shelf area would have increased this mean considerably. Thus, it was considered reasonable to advise fishers not to eat white croaker caught within the entirety of this geographic region, even though white croaker collected from segments 6 and 7 and EPA A had PCB concentrations that were low enough that consumption of one or more servings per week would be considered safe (white croaker were not collected from segments 8-11). Mean PCB concentrations in white croaker from coastal areas north of segment 5 (segments 1-4) and south of segment 24 (segments 19-22 and EPA D) were much lower (33 and 35 ppb, respectively), falling into the two servings per week category for all population groups. DDT levels in these two regions were low (mean: 111 ppb) and did not affect advice.

Sampling segments were established by MSRP/EPA to distribute sampling across the region; samples may not have been collected throughout a segment or near segment boundaries. Segment 5 is bounded on the north by the west end of Santa Monica Beach (also the northern

most point of Santa Monica Beach). However, for segment 5, no fish were collected north of approximately one mile south of Santa Monica Pier. White croaker samples collected at Santa Monica Pier in November, 2006, by the City of Los Angeles, Hyperion Treatment Plant, showed that PCB, DDT and mercury levels averaged 52 ppb, 49 and 138 ppb, respectively (City of Los Angeles, 2007), falling into the one serving per week category for all populations. For this reason, OEHHA determined that the "do not consume" region for white croaker should extend from Santa Monica Beach south of Santa Monica Pier in the north to Seal Beach Pier (approximately the Orange County line) in the south. In areas north (Ventura Harbor to Santa Monica Pier) and south (south of Seal Beach Pier to San Mateo Point), OEHHA considers it safe for women over 45 years and men to consume two servings per week of white croaker, based on average PCB concentrations found in this species. However, because of the potential combined effects of PCBs and mercury (mean: 118 ppb), women 18-45 years and children 1-17 years are advised to consume no more than one serving per week of white croaker in these areas.

Topsmelt:

Thirty topsmelt were collected from three Los Angeles County segments. Topsmelt were analyzed as whole body composites because of their small size. Additionally, fishers may eat topsmelt as whole bodies. The mean PCB, DDT, and mercury concentrations for these three segments were 113, 217 and 25 ppb, respectively. Although the overall mean PCB concentration neared the "do not consume" cutoff, PCB levels were low at one of the three segments (8; 37 ppb) and moderate at one segment (16; 86 ppb). The mean PCB concentration at segment 5, however, was one of the highest reported for any MSRP/EPA segment (215 ppb) and it was the highest PCB segment mean for any species other than white croaker. As noted above, high lipid levels in fish at segment 5 may have played a role in the higher than expected accumulation of PCBs in that area; topsmelt were not collected at other high PCB sites near the Palos Verdes peninsula. Because topsmelt clearly have the potential to accumulate high PCB concentrations, it was considered prudent to advise fishers not to consume topsmelt in the same geographic area where they are advised not to eat white croaker (bounded by Santa Monica Beach south of Santa Monica Pier in the north to Seal Beach Pier [near the Orange County line] in the south). There were no topsmelt samples collected from lower PCB areas in Ventura County, northern Santa Monica Bay, or Orange County. However, OEHHA determined that segment 8 data were a reasonable surrogate for these areas and, thus, considers it safe for fishers to consume two servings per week of topsmelt from areas north (Ventura Harbor to the Santa Monica Pier) and south (Orange County) of the "do not consume" zone.

Barred sand bass:

A total of 66 barred sand bass were collected from 12 segments in Los Angeles and Orange counties. Mean PCB and DDT concentrations were 62 and 344 ppb, respectively. Examination of the data showed that fish collected from one segment (13-14) had PCB and DDT concentrations that were higher than other segments (158 ppb and1,540 ppb, respectively) and exceeded the "do not consume" cutoff for PCBs; however, there were only six fish collected from this segment. Of the 39 individual barred sand bass collected from segments 12, 13-14, 15, 16, 17 and EPA A (considered higher PCB areas), eleven met or exceeded the "do not consume" level for PCBs (Figure 3); ten of the 31 barred sand bass collected from 12, 13-14, and 15 met or exceeded this level. Mercury levels were moderate and similar among all sites (mean: 195 ppb) (Figure 4). Given the relatively high frequency of elevated PCB levels in barred sand bass caught around the Palos Verdes peninsula area, OEHHA considers it prudent to recommend that fishers do not consume this species when caught in this area. For ease of communication and to be health protective (barred sand bass were not collected from segment 5 where PCBs were elevated

in other species), the “do not consume” region for this species was extended to encompass the same geographic area as the “do not consume” region for white croaker and topsmelt, i.e., Santa Monica Beach south of the Santa Monica Pier to Seal Beach Pier (near the Orange County line). Barred sand bass caught from Ventura Harbor to the Santa Monica Pier and from south of Seal Beach Pier to San Mateo Point (Orange County) are safe for women over 45 years and men to eat two servings per week, based on PCB concentrations. Based on the potential combined effects of mercury and PCBs, OEHHA considers it safe for women 18-45 years and children 1-17 years to consume one serving per week of barred sand bass in these lower-PCB areas.

Fish with no Site-related Differences:

Black croaker:

A total of 35 black croaker were collected from four segments in Los Angeles County. PCB and DDT concentrations were uniformly low in this species (averaging 21 ppb and 71 ppb, respectively), while mercury levels were moderately high and similar across segments (mean: 454 ppb). Because of the consistency of contaminant levels across segments, and the unlikelihood that there are significant point sources of mercury contamination in the area, regional advice was not developed for this species. Based on mercury concentrations, OEHHA concluded that women 18-45 years and children 1-17 years should not eat black croaker; however, it is safe for women over 45 years and men to eat one serving per week of this species.

California corbina:

A total of 40 California corbina were collected from four segments in Los Angeles and Orange counties. Mean PCB, DDT, and mercury levels were relatively low (mean: 30, 54, and 86 ppb, respectively) and consistent among sites. Thus, regional advice was not developed for corbina. Based on PCB levels for all populations and, additionally, mercury concentrations for women 18-45 years and children 1-17 years, OEHHA advises that it is safe for all population groups to eat two servings per week of California corbina.

California halibut:

A total of 24 California halibut were collected from three segments in Los Angeles County. Mean PCB, DDT, and mercury concentrations were comparatively low (30, 103 and 139 ppb, respectively) and showed no identifiable site-related pattern. Based on PCB concentrations, OEHHA determined that it safe for women over 45 years and men to eat two servings per week of California halibut. Because of the potential combined effects of mercury and PCBs, women 18-45 years and children 1-17 years are advised to consume no more than one serving per week of this species.

California scorpionfish:

A total of 84 California scorpionfish were collected from nine segments in Los Angeles and Orange counties. PCB and mercury levels were moderate (57 and165 ppb, respectively), while DDT concentrations were relatively low (314 ppb). There was no site-related pattern of contamination. Based on PCB levels for all populations and, additionally, mercury concentrations for women 18-45 years and children 1-17 years, OEHHA concluded that it is safe for all population groups to eat one serving per week of California scorpionfish.

California sheephead:

Only three California sheephead were collected from the study region. OEHHA considers this insufficient sample size for the development of consumption advice.

Jacksmelt:

A total of 20 jacksmelt were collected from two segments (8 and 16) in Los Angeles County. Jacksmelt were analyzed as whole bodies. Contaminant levels were uniformly low (mean: 5, 26 and 76 ppb for PCBs, DDTs, and mercury, respectively). Based on mercury levels, it is safe for women 18-45 years and children 1-17 years to eat four servings of jacksmelt per week. Women over 45 years and men can eat seven servings per week of jacksmelt. Because jacksmelt are similar in appearance to topsmelt and there was an approximately10-fold difference in PCB concentrations between the two species at the same segments (8 and 16), special care must be taken to inform fishers how to distinguish them.

Kelp bass:

A total of 69 kelp bass were collected from 10 segments in Los Angeles and Orange counties. DDT concentrations were consistently low, with a mean concentration of 227 ppb. PCBs levels varied considerably, however, ranging from 10 ppb in northern Santa Monica Bay (segment 2) to 126 ppb in the Los Angeles/Long Beach Harbor area (segment 17), with a mean of 63 ppb. Mercury levels did not vary significantly among sites, ranging from 118 to 323 ppb (mean: 198 ppb). Although a PCB concentration of 126 ppb would result in more restrictive consumption advice compared to any other segment, only one fish was collected from segment 17. As such, it was determined that a grand mean of all sites would be used to develop consumption advice for kelp bass. Based on PCB levels for all populations and, additionally, mercury concentrations for women 18-45 years and children 1-17 years, OEHHA concluded that it is safe for all population groups to eat one serving per week of kelp bass.

Opaleye:

A total of 54 opaleye were collected from seven segments in Los Angeles and Orange counties. DDT concentrations were extremely low (mean: 1 ppb), while mercury levels were low and relatively stable across sites (mean: 46 ppb). PCB concentrations varied from 3 ppb in Orange County (segment 19) to 88 ppb near the Palos Verdes peninsula (segment 15), with an overall mean of 30 ppb. Examination of the PCB data for all segments did not show a consistent pattern of contamination that would lend itself to regional advice. Based on PCB concentrations, OEHHA determined that it is safe for all population groups to eat two servings per week of opaleye.

Pacific barracuda:

A total of 20 Pacific barracuda were collected from two segments in Los Angeles and Orange counties. Fish from each segment were analyzed as composites. Means of the composites were 42, 92, and 308 ppb for PCBs, DDTs, and mercury, respectively. Although PCB and mercury concentrations appeared higher in fish from segment 24 (near the Palos Verdes peninsula) compared to segment 25 in Orange County, differences may have been solely a result of fish length (327 and 288 mm, respectively). It is difficult to interpret data based on two composites. OEHHA recommends that, because of the possible combined effects of mercury and PCBs found

in this species, women 18-45 years and children 1-17 years should not eat Pacific barracuda. It is safe for women over 45 years and men to eat one serving per week of this species.

Pacific chub mackerel:

A total of 30 Pacific chub mackerel were collected from three segments in Los Angeles and Orange counties. All contaminant levels were consistently low and did not show significant differences among sites (16, 52, and 72 ppb for PCBs, DDTs, and mercury, respectively). Fishers are advised that, based on mercury concentrations, it is safe for women 18-45 years and children 1-17 years to eat two meals per week of Pacific chub mackerel. Based on PCBs, it is safe for women older than 45 years and men to eat four meals per week of this species.

Pacific sardine:

A total of 20 Pacific sardines were collected from four segments in Los Angeles County. Samples from segments 7 and 8 were combined into one composite as were samples from segments 15 and 16. Although there did appear to be differences in PCB concentrations between the two composites, sample size was inadequate to make this determination. It was concluded that using the mean of the composites (67, 204, and 19 ppb for PCBs, DDTs, and mercury, respectively) for developing consumption advice was appropriate and health protective. Based on PCB concentrations, all fishers are thus advised that it is safe to eat one serving per week of Pacific sardines.

Queenfish:

A total of 79 queenfish were collected from nine segments in Los Angeles County. Contaminant levels were relatively low and consistent across segments, with PCB, DDT, and mercury mean concentrations of 22, 65, and 99 ppb, respectively. Based on PCB levels for all populations and, additionally, mercury concentrations for women 18-45 years and children 1-17 years, OEHHA concluded that it is safe for all population groups to eat two servings per week of queenfish.

Rockfishes, combined:

A total of 29 rockfish (species combined) were collected from four segments in Los Angeles County. Mean PCB, DDT and mercury concentrations were 32, 181, and 142 ppb, respectively. PCB levels varied approximately four-fold over the four segments; however sample size was insufficient to determine if there were site-related differences, particularly because rockfish species were not analyzed separately. Based on average PCB concentrations, OEHHA determined that it is safe for women over 45 years and men to consume two servings per week of rockfishes. However, because of the potential combined effects of PCBs and mercury, OEHHA recommends that women 18-45 years and children 1-17 years eat only one serving per week of rockfishes.

Sargo:

A total of 38 sargo were collected from four segments in Los Angeles County. PCB, DDT, and mercury concentrations were relatively consistent across segments with a mean of 58, 98, and 159 ppb, respectively. Based on PCB levels for all populations and, additionally, mercury concentrations for women 18-45 years and children 1-17 years, OEHHA concluded that it is safe for all population groups to eat one serving per week of sargo.

Shovelnose guitarfish:

A total of 30 shovelnose guitarfish were collected from three contiguous segments in Los Angeles County in the Los Angeles/Long Beach Harbor area. Mean PCB, DDT and mercury concentrations were 37, 57 and 130 ppb, respectively. Based on individual PCB and mercury means, shovelnose guitarfish would fall into the two servings per week category; however, because of the potential combined effects of the two chemicals, OEHHA recommends that women 18-45 years and children 1-17 years eat no more than one serving per week of shovelnose guitarfish. Based on PCB concentrations, it is safe for women over 45 years and men to consume shovelnose guitar fish two servings per week.

Surfperches, combined:

During collection and analysis, surfperches were separated into benthic- (n=120) and water column-feeding (n=36) species. Samples were collected from 11 segments in Los Angeles and Orange counties. Although benthic-feeding surfperch species appeared to have modestly higher mean contaminant levels than did water column-feeding species, not all fish were collected from the same segments and only two water column-feeding surfperch were analyzed for mercury, making conclusions difficult to draw. More importantly, it is considered unlikely that many fishers can distinguish among the large variety of surfperch species. Thus, for the purpose of issuing fish consumption advisories, surfperch species were combined. The mean PCB, DDT and mercury concentrations for all surfperch species collected were 33, 87 and 77 ppb, respectively, and showed no particular site-related trends. Based on PCB levels for all populations and, additionally, mercury concentrations for women 18-45 years and children 1-17 years, OEHHA concluded that it is safe for all population groups to eat two servings per week of surfperches.

White seabass:

Nine white seabass were collected from one segment in Los Angeles County. OEHHA considers that, for this large of a geographic area, sample size was not sufficient to develop consumption advice for this species.

Yellowfin croaker:

A total of 30 yellowfin croaker were collected from three segments in Los Angeles and Orange counties. Fish were analyzed as a single composite from each segment. PCB, DDT and mercury concentrations were relatively low and similar among segments, with mean concentrations of 29, 38, and 90 ppb, respectively. There appeared to be no regional contaminant trends. Based on PCB levels for all populations and, additionally, mercury concentrations for women 18-45 years and children 1-17 years, OEHHA concluded that it is safe for all population groups to eat two servings per week of yellowfin croaker.

The Effects of Skinning on PCB and DDT Concentrations in Fish:

MRSP/EPA (2007) evaluated PCB concentrations in skin-on and skin-off fillets for two sides of the same fish in white croaker (bottom feeder) and kelp bass (water column feeder) samples from several sites. PCB and DDT concentrations were approximately three to 12 times higher for skin-on fillets compared to skin-off fillets (PCB data shown in Table 4). Based on numerous published reports showing that organochlorine levels are higher in the skin or other fatty parts, organ tissue, and in uncooked fish than they are in cooked skinless fillets (see Klasing and

Brodberg [2008]), OEHHA has always recommended that fishers eat only the fillet portions of fish, and skin, trim the fat and cook them thoroughly in ways (such as grilling) that allow the juices to drain from the fish. The data collected from the MSRP/EPA study show even higher ratios between skin-on and skin-off fillets than previously indicated, and so, in a geographic area where organochlorine levels are elevated, this advice is even more important to follow.

GUIDELINES FOR EATING FISH CAUGHT FROM VENTURA HARBOR TO SAN MATEO POINT

OEHHA generally issues regional consumption advice beginning at a consumption frequency of one eight-ounce serving per week (a total of six ounces of cooked fish per week), which is equivalent to two, three-ounces servings or the minimum weekly fish consumption rate recommended by the American Heart Association (AHA, 2008). Fish that can be eaten at this frequency represent fish with relatively low levels of mercury, PCBs, DDTs, and/or other contaminants. If, based on very low contaminant concentrations, fish can be consumed even more frequently than a total of six ounces (after cooking) per week, advice for consumption of two or three meals per week, or more, as appropriate, may also be provided. ATLs for four, five, six, and seven servings per week can be calculated, as in Klasing and Brodberg (2008), using consumption rates of 128, 160, 192, and 224 g/d, respectively. In addition, because of the potential beneficial effects from regular fish consumption, thought to stem largely from unique omega-3 fatty acids in fish, OEHHA encourages people of all ages, especially women 18-45 years and children, to eat fish that are low in mercury or other contaminants and high in omega-3 fatty acids. OEHHA recommends that consumers avoid regular consumption of fish that cannot safely be eaten at a minimum of six ounces (after cooking) a week.

Because of the complexity of communicating advice for so many species over such a wide geographic area, OEHHA determined that safe eating guidelines for fish from the southern California coast between Ventura Harbor and San Mateo Point should be divided into three distinct regions: 1) Ventura Harbor to Santa Monica Pier, 2) Santa Monica Beach South of the Santa Monica Pier to Seal Beach Pier, and 3) Orange County Coastal Waters south of Seal Beach Pier to San Mateo Point (Figure 5). Contaminant levels were very similar in the first (northern) and third (southern) regions and, thus, the consumption advice provided for these two areas is identical.

In all cases, **consumption advice should not be combined.** Fishers can choose one fish from the “1 serving a week” category to eat that week. Then they should not eat any other fish until the next week. If they choose fish that can be eaten 2 servings a week, for example, they can combine fish species from that group for a total of 2 servings in that week. Then they should not eat any other fish until the next week.

Recommendations for women 18-45 years, including pregnant and breastfeeding women, and children 1-17 years for eating fish from coastal regions between Ventura Harbor and the Santa Monica Pier

- Women 18-45 years and children 1-17 years **should not eat** barracuda or black croaker.
- Women 18-45 years and children 1-17 years can eat a total of **one serving a week** of barred sand bass, California halibut, California scorpionfish (also known as "sculpin"), kelp bass, rockfishes, sardines, shovelnose guitarfish, sargo, or white croaker (also known as "tomcod" or "kingfish").
- Women 18-45 years and children 1-17 years can eat a total of **two servings a week** of corbina, opaleye, Pacific chub mackerel, queenfish, surfperches, topsmelt, or yellowfin croaker.
- Women 18-45 years and children 1-17 years can eat a total of **four servings a week** of jacksmelt.
- Serving size for women is six ounces of fish after cooking (equal to eight ounces before cooking). Serving size can be adjusted to add one ounce of fish for every 20 pounds of body weight above, or subtract one ounce of fish for every 20 pounds of body weight below, the average weight of 160 pounds. Serving size for children up to age 12 is about half as much as adults (3 ounces of cooked fish).
- Eat only the fillet portion. Skin and trim all visible fat. Thoroughly cook before eating, preferably using a method that allows the juices to drain away.

Recommendations for women over 45 years and men for eating fish from coastal regions between Ventura Harbor and the Santa Monica Pier

- Women over 45 years and men can eat a total of **one serving a week** of barracuda, black croaker, California scorpionfish (also known as "sculpin"), kelp bass, sardines, or sargo.
- Women over 45 years and men can eat a total of **two servings a week** of barred sand bass, California halibut, corbina, opaleye, queenfish, rockfishes, shovelnose guitarfish, surfperches, topsmelt, white croaker (also known as "tomcod" or "kingfish"), or yellowfin croaker.
- Women over 45 years and men can eat a total of **four servings a week** of Pacific chub mackerel.
- Women over 45 years and men can eat a total of **seven servings a week** of jacksmelt.
- Serving size is six ounces of fish after cooking (equal to eight ounces before cooking). Serving size can be adjusted to add one ounce of fish for every 20 pounds of body weight above, or subtract one ounce of fish for every 20 pounds of body weight below, the average weight of 160 pounds.

- Eat only the fillet portion. Skin and trim all visible fat. Thoroughly cook before eating, preferably using a method that allows the juices to drain away.

Recommendations for women 18-45 years, including pregnant and breastfeeding women, and children 1-17 years for eating fish from coastal regions between Santa Monica Beach south of the Santa Monica Pier and Seal Beach Pier

- Women 18-45 years and children 1-17 years **should not eat** barracuda, barred sand bass, black croaker, topsmelt, or white croaker (also known as "tomcod" or "kingfish").
- Women 18-45 years and children 1-17 years can eat a total of **one serving a week** of California halibut, California scorpionfish (also known as "sculpin"), kelp bass, rockfishes, sardines, sargo, or shovelnose guitarfish.
- Women 18-45 years and children 1-17 years can eat a total of **two servings a week** of corbina, opaleye, Pacific chub mackerel, queenfish, surfperches, or yellowfin croaker.
- Women 18-45 years and children 1-17 years can eat a total of **four servings a week** of jacksmelt.
- Serving size for women is six ounces of fish after cooking (equal to eight ounces before cooking). Serving size can be adjusted to add one ounce of fish for every 20 pounds of body weight above, or subtract one ounce of fish for every 20 pounds of body weight below, the average weight of 160 pounds. Serving size for children up to age 12 is about half as much as adults (3 ounces of cooked fish).
- Eat only the fillet portion. Skin and trim all visible fat. Thoroughly cook before eating, preferably using a method that allows the juices to drain away.

Recommendations for women over 45 years and men for eating fish from coastal regions between Santa Monica Beach south of Santa Monica Pier and Seal Beach Pier

- Women over 45 years and men **should not eat** barred sand bass, topsmelt, or white croaker (also known as "tomcod" or "kingfish").
- Women over 45 years and men can eat a total of **one serving a week** of barracuda, black croaker, California scorpionfish (also known as "sculpin"), kelp bass, sardines, or sargo.
- Women over 45 years and men can eat a total of **two servings a week** of California halibut, corbina, opaleye, queenfish, rockfishes, shovelnose guitarfish, surfperches, or yellowfin croaker.
- Women over 45 years and men can eat a total of **four servings a week** of Pacific chub mackerel.
- Women over 45 years and men can eat a total of **seven servings a week** of jacksmelt.

- Serving size is six ounces of fish after cooking (equal to eight ounces before cooking). Serving size can be adjusted to add one ounce of fish for every 20 pounds of body weight above, or subtract one ounce of fish for every 20 pounds of body weight below, the average weight of 160 pounds.
- Eat only the fillet portion. Skin and trim all visible fat. Thoroughly cook before eating, preferably using a method that allows the juices to drain away.

Recommendations for women 18-45 years, including pregnant and breastfeeding women, and children 1-17 years for eating fish from the southern California coast south of Seal Beach Pier to San Mateo Point

- Women 18-45 years and children 1-17 years **should not eat** barracuda or black croaker.
- Women 18-45 years and children 1-17 years can eat a total of **one serving a week** of barred sand bass, California halibut, California scorpionfish (also known as "sculpin"), kelp bass, rockfishes, sardines, sargo, shovelnose guitarfish, or white croaker (also known as "tomcod" or "kingfish").
- Women 18-45 years and children 1-17 years can eat a total of **two servings a week** of corbina, opaleye, Pacific chub mackerel, queenfish, surfperches, topsmelt, or yellowfin croaker.
- Women 18-45 years and children 1-17 years can eat a total of **four servings a week** of jacksmelt.
- Serving size for women is six ounces of fish after cooking (equal to eight ounces before cooking). Serving size can be adjusted to add one ounce of fish for every 20 pounds of body weight above, or subtract one ounce of fish for every 20 pounds of body weight below, the average weight of 160 pounds. Serving size for children up to age 12 is about half as much as adults (3 ounces of cooked fish).
- Eat only the fillet portion. Skin and trim all visible fat. Thoroughly cook before eating, preferably using a method that allows the juices to drain away.

Recommendations for women over 45 years and men for eating fish from coastal regions of Orange County south of Seal Beach Pier to San Mateo Point

- Women over 45 years and men can eat a total of **one serving a week** of barracuda, black croaker, California scorpionfish (also known as "sculpin"), kelp bass, sardines, or sargo.
- Women over 45 years and men can eat a total of **two servings a week** of barred sand bass, California halibut, corbina, opaleye, queenfish, rockfishes, shovelnose guitarfish, surfperches, topsmelt, white croaker (also known as "tomcod" or "kingfish", or yellowfin croaker.
- Women over 45 years and men can eat a total of **four servings a week** of Pacific chub mackerel.

- Women over 45 years and men can eat a total of **seven servings a week** of jacksmelt.
- Serving size is six ounces of fish after cooking (equal to eight ounces before cooking). Serving size can be adjusted to add one ounce of fish for every 20 pounds of body weight above, or subtract one ounce of fish for every 20 pounds of body weight below, the average weight of 160 pounds.
- Eat only the fillet portion. Skin and trim all visible fat. Thoroughly cook before eating, preferably using a method that allows the juices to drain away.

Figure 1. Map of Sampling Segments for MSRP/EPA Study

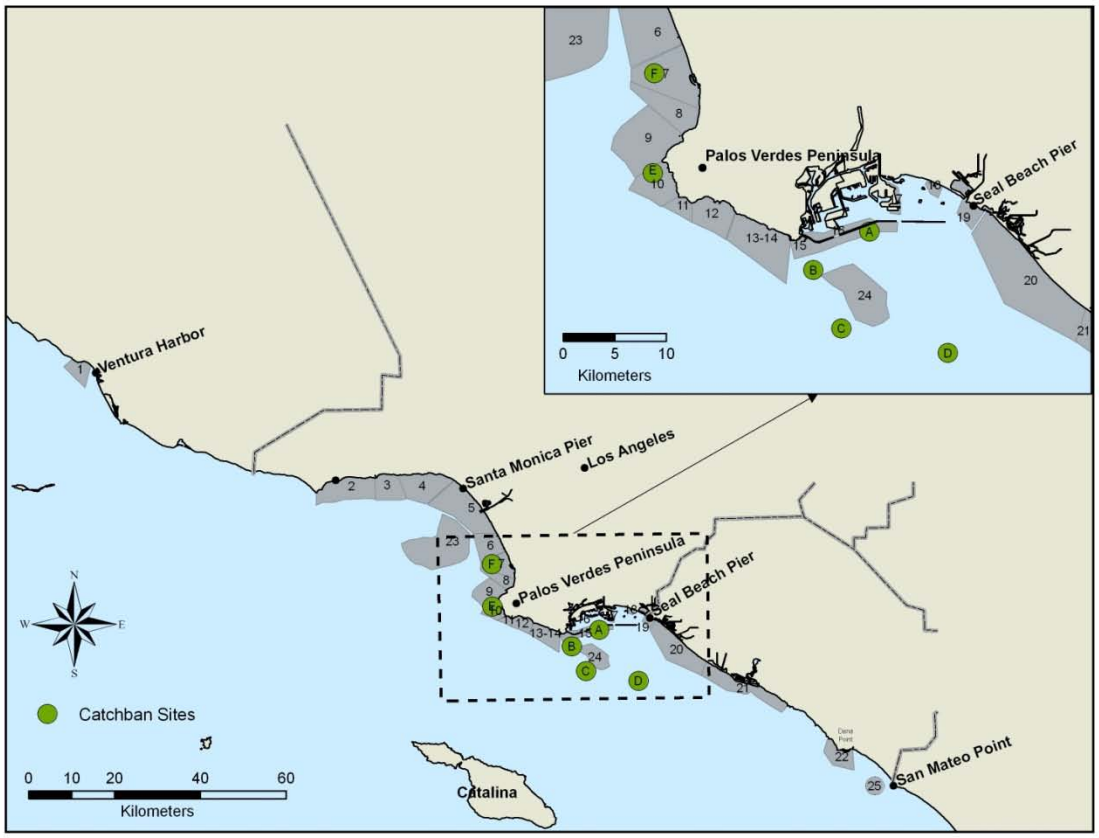


Figure 2. PCB Levels in White Croaker from Marina del Rey to Seaport Village (MSRP/EPA and LACSD data)

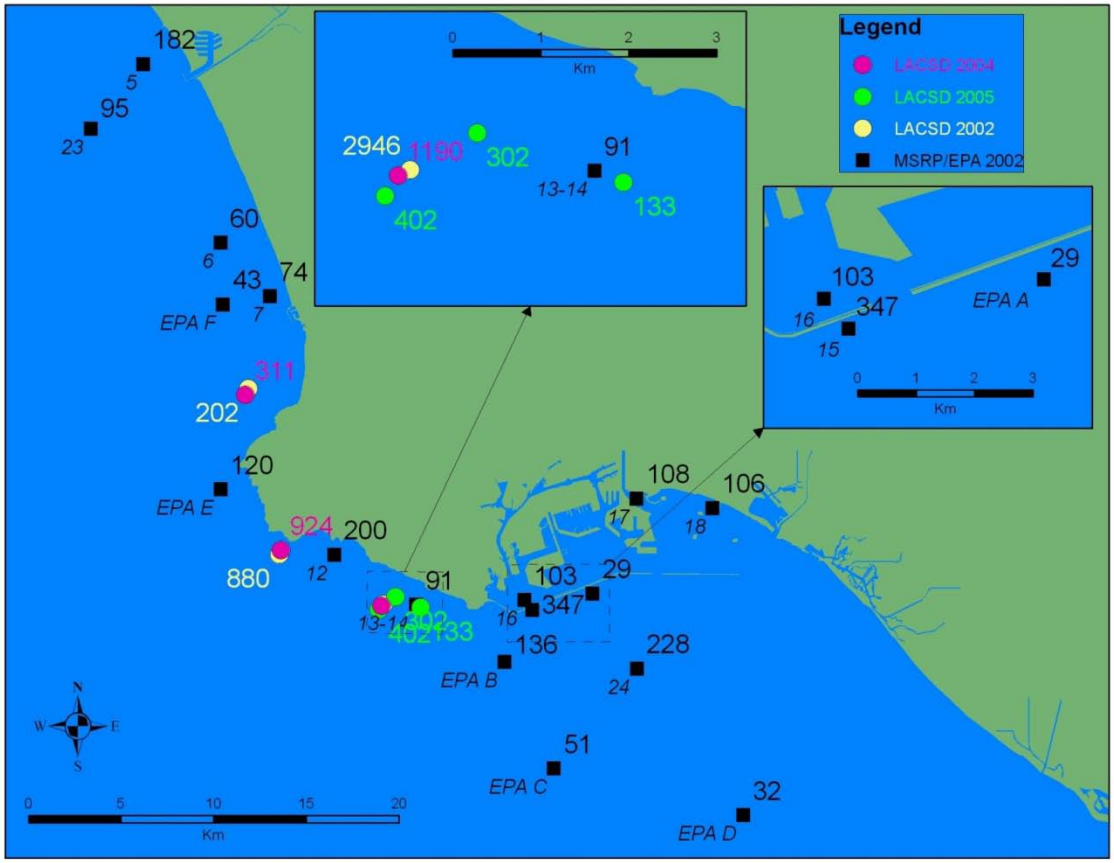


Figure 3. PCB Concentrations in Individual Barred Sand Bass

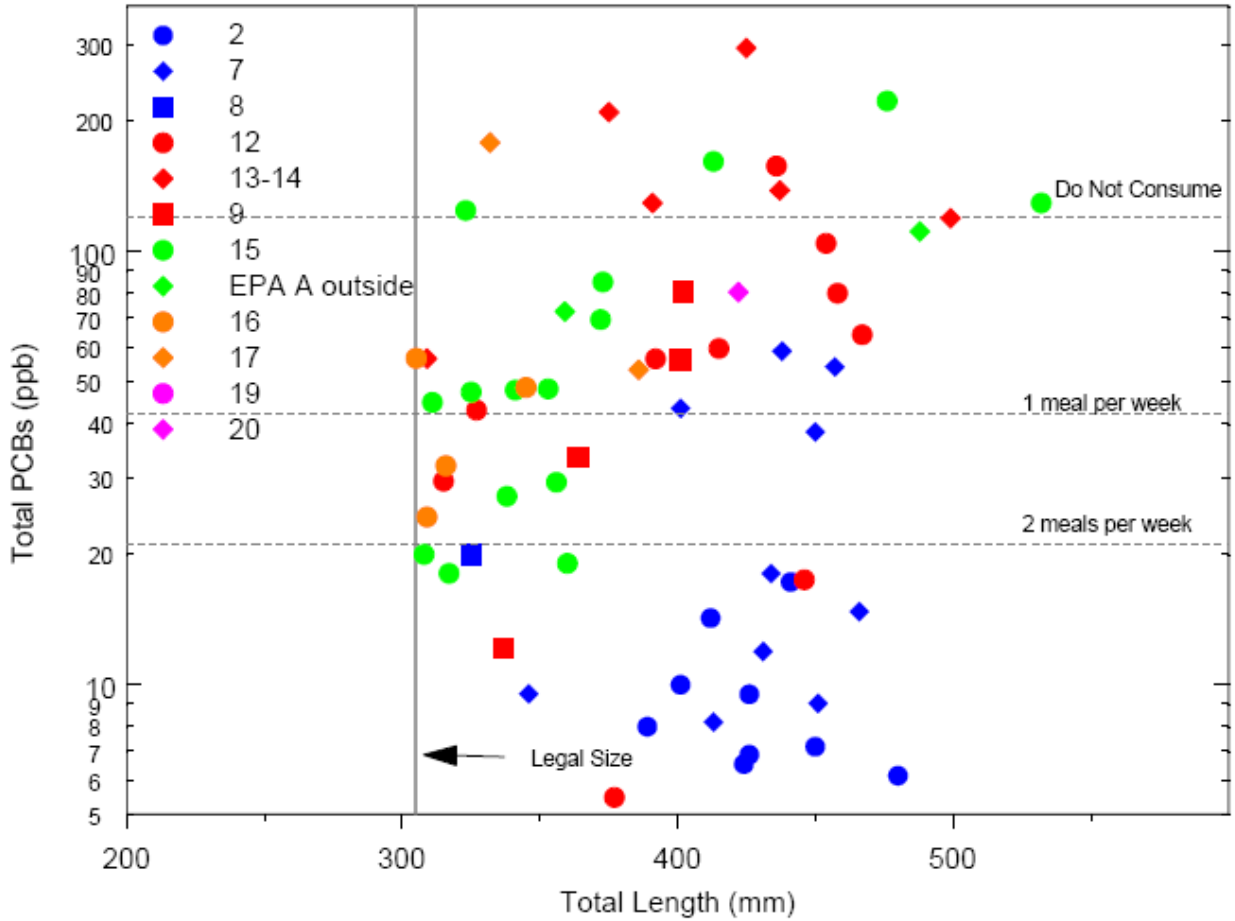


Figure 4. Mercury Concentrations in Individual Barred Sand Bass

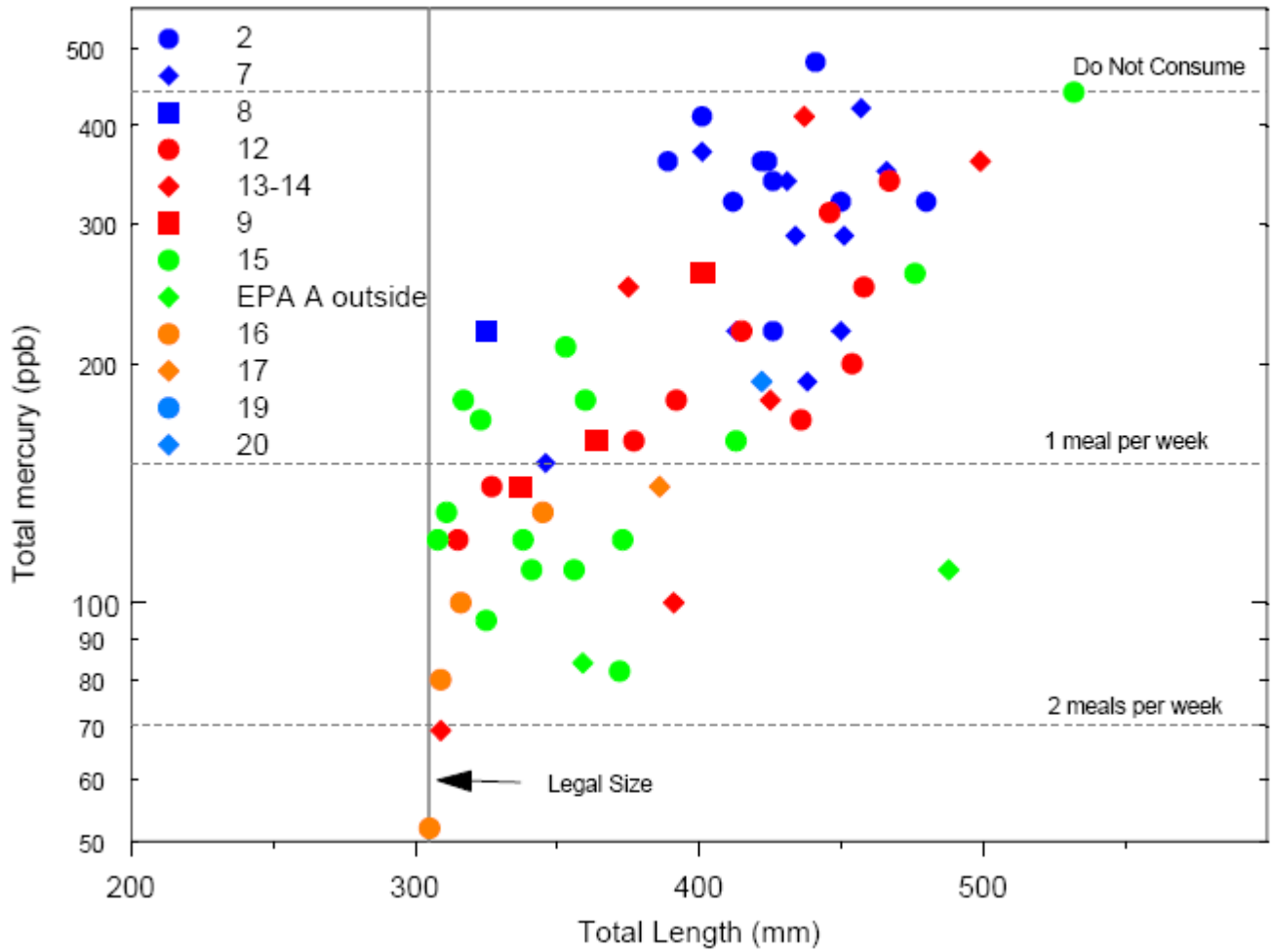


Figure 5. Health Advisory and Safe Eating Guideline Regions

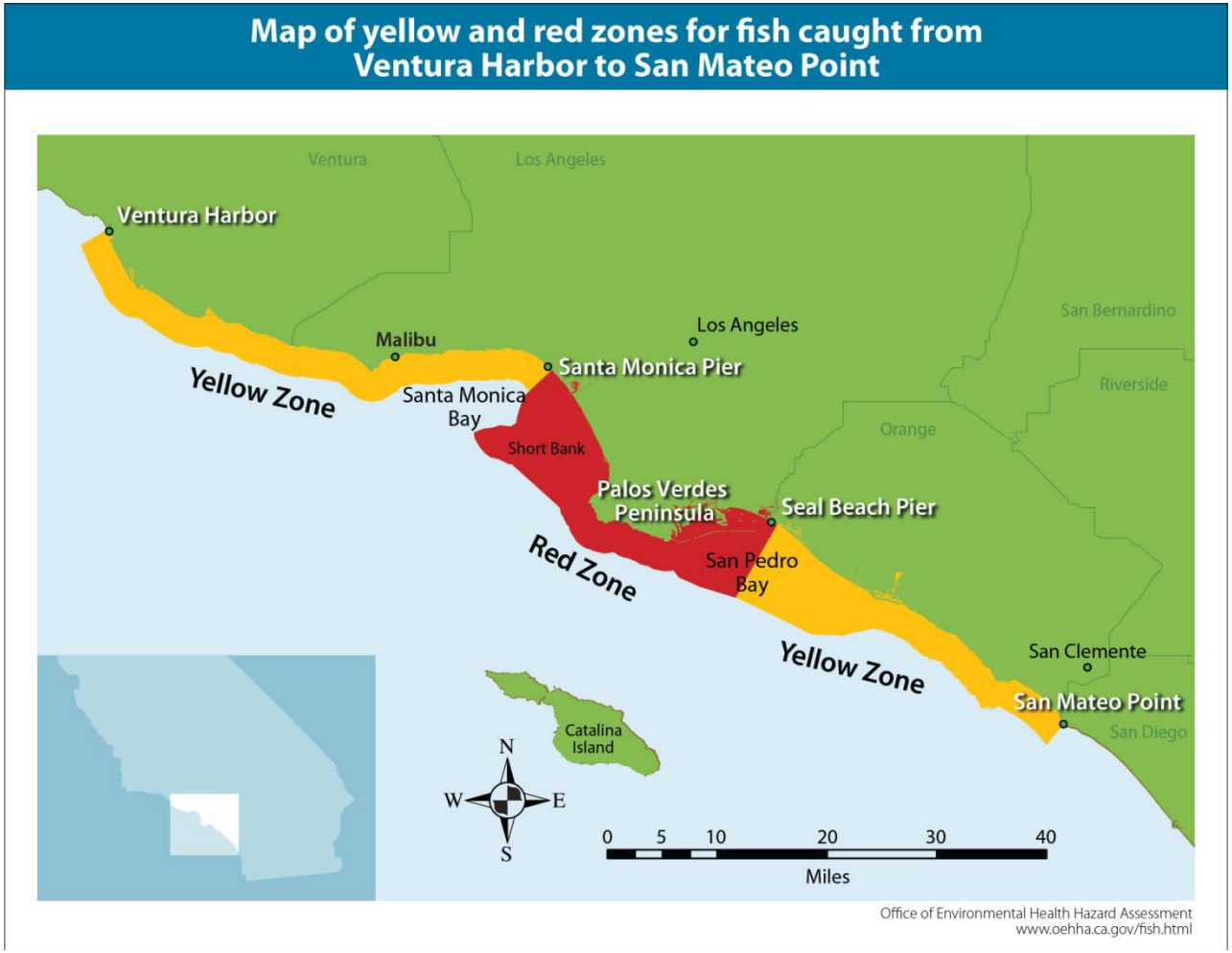


Table 1. Segments, Species and Sample Size for Fish Collected from Ventura Harbor to San Mateo Point

Segment	Description	Barred Sand Bass	Black Croaker	California Corbina	California Halibut	California Scorpionfish	California Sheephead	Jacksmelt	Kelp Bass	Opaleye	Pacific Barracuda	Pacific Chub Mackerel	Pacific Sardine	Queenfish	Rockfishes	Sargo	Shovelnose Guitarfish	Surfperches, BF[1]	Surfperches, WCF[2]	Topsmelt	White Croaker	White Seabass	Yellowfin Croaker
1	Ventura: Emma Wood Beach to San Buenaventura Beach																				9		
2	Pt. Dume to W. End of Malibu Lagoon Beach	10							10			10		10	6	10		10			5		
3	W. End of Malibu Lagoon Beach to Las Flores													10							10		
4	Las Flores to W. End of Santa Monica Beach													10							10		
5	Santa Monica Beach to El Segundo				8	10				10								10		10	6		10
6	El Segundo to S. End of Manhattan Beach					10															10		
7	King Harbor Area: S. End of Manhattan Beach to Redondo Beach	10	10	10					10	10			5	9		8		10	10		10		
8	Redondo Beach to Flat Rock Pt.	1						10		10			5					10		10		9	
9	Flat Rock Pt. To Palos Verdes Pt.	4																					
10	Palos Verdes Pt. to Pt. Vicente																						
11	Pt. Vicente to Long Pt.																						
12	Long Pt. to Bunker Pt.	10				8									3						9		
13/14	Bunker Pt. to Pt. Fermin	6	5			10			10	1		10			10			10			7		
15	Cabrillo/LA Breakwater: Ocean Side	15				14	3		22	3			9	3	10	10		20	5		9		
16	Cabrillo/LA Breakwater: Inland Side	4		10	6	10		10	2				1	10			10	10	8	10	10		

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Segment	Description	Barred Sand Bass	Black Croaker	California Corbina	California Halibut	California Scorpionfish	California Sheephead	Jacksmelt	Kelp Bass	Opaleye	Pacific Barracuda	Pacific Chub Mackerel	Pacific Sardine	Queenfish	Rockfishes	Sargo	Shovelnose Guitarfish	Surfperches, BF[1]	Surfperches, WCF[2]	Topsmelt	White Croaker	White Seabass	Yellowfin Croaker
17	Pier J to Finger Piers at Shoreline Park	2			10				1	10				10			10	10	5		10		
18	Belmont Pier/Seaport Village			10										9		10	10	10			10		10
19	Seal Beach: Alamitor Bay Jetties to Anaheim Bay	1				7			4	10								10	8		9		10
20	W. End of Sunset Beach to Huntington Beach	1							2												10		
21	Huntington Beach (Hwy. 39) to Pelican Pt.			10																	10		
22	Dana Pt.: E. End of Mussel Cove to E. End of Doheny Beach											10									8		
23	Short Bank					10															10		
24	Horseshoe Kelp					5			2		10										8		
25	San Mateo Pt.										10												
A/in	Middle Breakwater		10																				
A/out	Middle Breakwater	2	10						6					8				10			39		
B	Approximately 2 Miles Offshore of Segment 15																				39		
C	Approximately 5 miles Southeast of Pt. Fermin																				39		
D	Approximately 7 miles South-southeast of Station A																				28		
E	W. of Palos Verdes Pt. before Redondo Canyon																				29		
F	W. of Station E on the North Side of Redondo Canyon																				5		

[1]Benthic feeding; [2]Water-column feeding

Table 2. Overall mean[1] PCB, DDT, and Mercury (Hg) concentration (ppb, wet weight) and length (mm) of fish collected from Ventura Harbor to San Mateo Point						
	PCBs	DDTs	Hg[2]	Length	Segments Collected	Number of Fish
Barred sandbass	62	344	195	387	2,5*,7-9,12-17,19,20,A	66
Black croaker	21	71	454	309	7,13,14,A	35
California corbina	30	54	86	308	7,16,18,21	40
California halibut	30	103	139	645	5,16,17	24
California scorpionfish	57	314	166	298	5,6,12-16,19,23,24	84
California sheephead	68	609	107	351	15	3
Jacksmelt	5	26	76	294	8,16	20
Kelp bass	63	227	198	388	2,7,12*,13-17,19,20,24,A	69
Opaleye	30	1	46	308	5,7,8,13,14,15,17,19	54
Pacific barracuda	42	92	308	815	24,25	20
Pacific chub mackerel	16	52	72	313	2,7*,13-14,21*,22	30
Pacific sardine	67	204	19	207	7,8,15,16	20
Queenfish	22	65	99	178	2,3,4,6*,7,15-18,19*,A	79
Rockfishes, combined	32	181	142	278	2,12,13-15	29
Sargo	58	98	159	316	2,7,15,18	38
Shovelnose guitarfish	37	57	130	747	16-18	30
Surfperches, combined	33	87	77	232	2,5,7,8,13-19,A	156
Topsmelt	113	217	25	166	5,8,16	30
White croaker	91	549	108	218	1-7,12-24,A,B,C,D,E,F	349
White seabass	13	66	203	840	8	9
Yellowfin croaker	29	38	90	243	5,18,19	30

[1]Means were calculated as the non-weighted average of segment means for each species.
[2]Mean values are based on additional fish that were analyzed for mercury not included in the MSRP/U.S. EPA (2007) report; see NOAA (2009) for complete dataset.
*Fish from these segments were analyzed for Hg mercury only.

Table 3. Advisory Tissue Levels (ATLs) for PCBs, DDTs, and Methylmercury Based on Cancer or Non-Cancer Risk Using an 8-Ounce Serving Size (Prior to Cooking) (ppb, wet weight)				
Contaminant	**Three 8-ounce Servings* a Week**	**Two 8-ounce Servings* a Week**	**One 8-ounce Servings* a Week**	**No Consumption**
DDTs	≤520	>520-1,000	>1,000-2,100	>2,100
Methylmercury (Women aged 18-45 years and children aged 1-17 years)	≤70	>70-150	>150-440	>440
Methylmercury (Women over 45 years and men)	≤220	>220-440	>440-1,310	>1,310
PCBs	≤21	>21-42	>42-120	>120

For each chemical, ATLs were calculated separately for cancer and non-cancer risk, if appropriate, for consumption frequency categories of one, two, and three 8-ounce servings per week. Values for cancer and non-cancer risk were then compared to determine whether the cancer or non-cancer value was the most health-protective. For all chemicals except DDTs, either cancer or non-cancer risk determined the ATL for each consumption frequency category. For DDTs, consumption advice for one serving per week was based on cancer risk, while consumption advice for two and three servings per week was based on non-cancer risk.
*Serving sizes are based on an average 160 pound person. Individuals weighing less than 160 pounds should eat proportionately smaller amounts (for example, individuals weighing 80 pounds should eat one 4-ounce serving a week when the table recommends eating one 8-ounce serving a week).

Tabled values are rounded based on laboratory reporting of three significant digits in results, where the third reported digit is uncertain (estimated). Tabled values are rounded to the second digit, which is certain. When data are compared to this table they should also first be rounded to the second significant digit as in this table.

Table 4. PCB Concentrations (ppb) in Skin-off and Skin-on Fillets from the Same Fish					
Species	Segment	PCBs Skin-off	PCBs Skin-on	Ratio	Number of Fish
Kelp Bass	2	12.2	85.4	7.3	4
Kelp Bass	7	28.3	113.4	4.3	4
Kelp Bass	13-14	50.2	141	2.8	4
White croaker	5	163	448	2.8	2
White croaker	EPA A	60.8	279	5.2	6
White croaker	13-14	89.7	724	11.1	6

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