



Project Summary

Consumption Rates of Potentially Hazardous Marine Fish Caught in the Metropolitan Los Angeles Area

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In 1978, the California Department of Fish and Game carried out a major independent sportfishing survey in Southern California.¹ Results indicated that considerable fishing effort was expended (one million angler-trip hours per year), that 75% of the catch was composed of 20 species, and that one in three fish caught was a white croaker. White croaker has been shown to contain large amounts of DDT (average = 39 $\mu\text{g/g}$)² and polychlorinated biphenyl (PCB). Concentrations of PCBs have been reported that range from 0.6 $\mu\text{g/g}$ within the Los Angeles Harbor³ to 2.8 $\mu\text{g/g}$ near the White Point sewage outfall.² The survey also reported some catches of shellfish. Shellfish have been shown to be contaminated with heavy metals as well as the carcinogen benzo(a)pyrene. No data were obtained, however, to indicate that the fishermen consumed the fish or shellfish.

This report presents the results of a 1980 survey to assess the consumption rates of potentially hazardous marine fish and shellfish by nonprofessional anglers in the Los Angeles metropolitan area; to identify population subgroups with a significant consumption rate; and to estimate the size of the population potentially exposed to harmful pollutants.

This Project Summary was developed by EPA's Environmental Research Laboratory, Corvallis, OR, to announce key findings of the research project that is fully documented in a separate report of the same title (see Project Report ordering information at back).

Introduction

During the period of October to December 1979, a questionnaire on sportfishing and catch consumption was designed to obtain information from fishermen in the Los Angeles Metropolitan area: (a) demographic characteristics of the fishermen and their family/living group; (b) patterns of fishing activity; (c) species, numbers, and weights of fish caught; and (d) characteristics of fish consumption in the family/living group. Distinction was made between those fishermen who caught fish for consumption and those who caught fish for other purposes (for example, pet food or fertilizer).

Location of Survey Sites

Numerous fishing locations in the harbor and coastal areas of Los Angeles were evaluated as possible survey sites and 12 representative locations were identified. The California Department of Fish and Game confirmed that these sites (Figures 1a and 1b) were fished

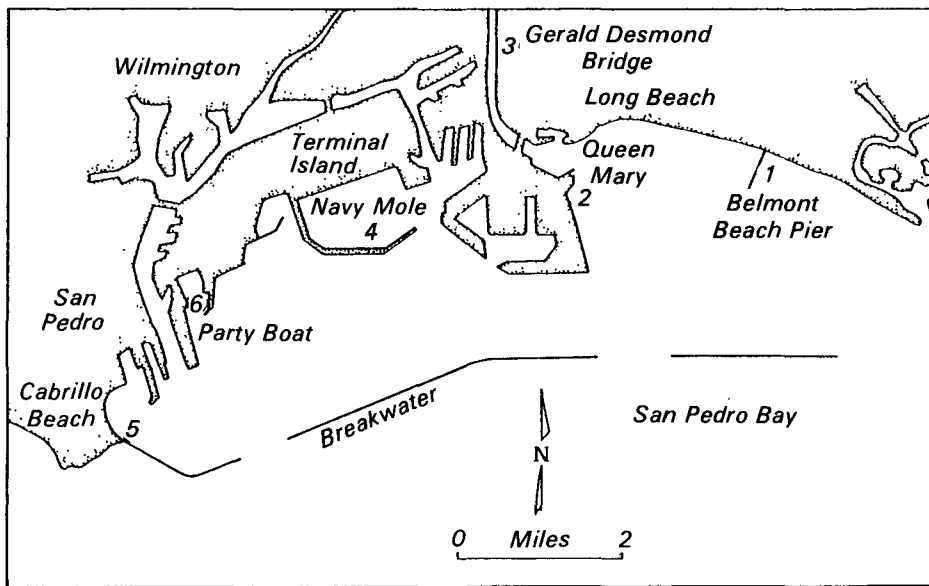


Figure 1a. Location of survey sites. (Team 1).

frequently and contained abundant marine life. In addition, the sites were affected by varying degrees of pollution. Two of the sites (sites 7 and 8) were near sewage outfalls. The major Los Angeles County piers were included in the survey (sites 1, 5, and 8-11). Party boats (sites 6 and 12) were included because many sportfishermen do not fish from piers, shore, or breakwater areas. Fishermen using private boats were excluded from the study because their fishing sites were too random, ranging from areas of pollution impact to pristine waters, and covered too broad an area to be surveyed adequately with the resources available.

Surveying Procedures

Four surveyors visited each of the 12 sites, usually in teams of two. Attempts were made to survey each site approximately three times/month on different days of the week and different times of the day.

The survey period was January 1 through December 31, 1980; 400 visits were made to the 12 sites. On each visit, surveyors recorded the number of fishermen at the site, their sex, race, and approximate age. All fishermen were counted; however, only those with fish were interviewed. No fisherman was interviewed more than once during the study. When more than 20 fishermen at a site had fish, a systematic sampling approach was used.

Results

From January 1 to December 31, 1980 a total of 1,059 interviews were conducted from an estimated sportfishing population of at least 31,351. About 60% of the interviews were done during the week, 40% on the weekend. Nearly two-thirds of the survey days were sunny. During January, mid-February, and March, heavy rains caused a reduction in the number of interviews. Heavy erosion and landslide conditions closed Abalone Cove (site 7) from late March until November; consequently, Point Vicente was substituted as a survey site (see Figures 1a and 1b). In early spring, quarantines of about ten days were imposed in Santa Monica Bay and Los Angeles/Long Beach harbors due to heavy sewage overflow. During that period, interviews could not be obtained. Also, Gerald Desmond Bridge (site 3) was closed in March and from mid-September to December. Illegal disposal of chemicals caused closure of sites 9-11 from December 9 to 17.

Demographic characteristics of the interviewed sportfishermen and their family/living groups indicate the majority of those interviewed were male, Caucasian, 18 to 40 years old, employed, and living with three or more persons.

Youths (≤ 17 years) who fished with their parents were under-represented in the interviewed sample since, in most cases, the adult was interviewed

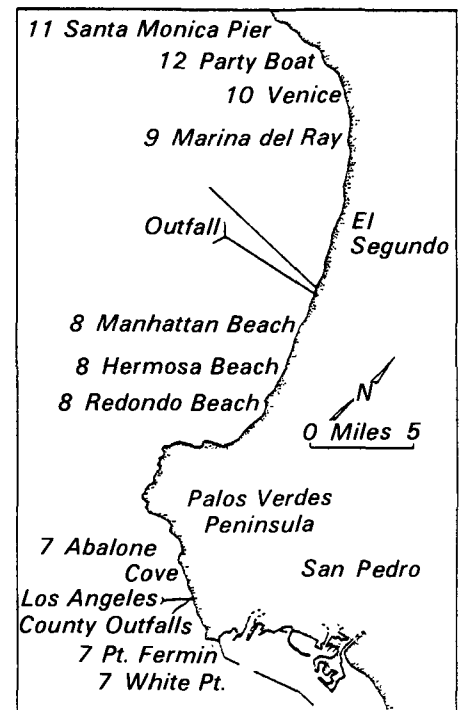


Figure 1b. Location of survey sites. (Team 2).

as the representative family member. Also, Orientals (especially Samoans) and Mexican-Americans may have been under-represented since many did not speak English and therefore could not be interviewed.

Approximately half of the fishermen fished one or more times per week, and more than half had been fishing four or more hours at the time of the interview. The frequency of eating fish was generally the same as or larger than the frequency of fishing.

White croaker were by far the most common fish caught. Shellfish, primarily crabs and mussels, constituted only 3% of the catch.

The majority of fishermen interviewed consumed the fish they caught, and the most common preparation method was pan frying. Although few fishermen primarily ate raw fish, 8% said they ate it occasionally. Of the raw fish consumed, 16% were white croaker, 32% were bonito, and 12% were Pacific mackerel.

The median amount consumed was 37 g/day/person, with the 90th percentile at 225 g/day/person (i.e., 10% of the fishermen consumed more than this amount) -- much higher than the average fish consumption for the United States population as a whole

(estimated at about 18.7 g/day).⁴ Although shoreline fishermen are shown to consume fish at rates considerably above the national average, it must be remembered that: (a) these data are biased toward frequent fishermen since they are more likely to be interviewed at any given time; (b) these data do not take into account consumption of store-bought fish or dietary sources which might be displaced by eating locally caught fish; and (c) the recorded catch may represent a fraction of the entire catch.

There were significantly larger consumption rates among senior citizens (65 years or older) and among the Oriental/Samoan subgroup ($P < 0.001$). Also, more fish were consumed from catches taken at site 8 ($P < 0.001$), a site likely to be influenced by waste discharge.

Frequent fishermen tended to be older, Caucasian, and lived either alone or in a smaller family group.

Logbook data were used to estimate the size of the population of sportfishermen at each of the 10 sites, excluding party boats. Party boats were not included since no data were obtained on the number and size of all party boats in the Los Angeles coastal area. Estimates were based on fishermen counts obtained from the logbook data. Distinction was made between weekday and weekend counts.

The results of this study show that there exists a regular fishing population along the Southern California shoreline (14% fish 3 to 7 times/week), even at sites likely to be influenced by waste discharges (sites 7 and 8). Fish caught by frequent as well as infrequent fishermen are generally shared and consumed among at least 101,000 family members (Table 1).

The catches are dominated by a few species (Table 2) including two, white croaker and Pacific bonito, which accumulate trace organics including polychlorinated biphenyls. PCBs have long been shown to produce toxic effects in prolonged industrial exposure⁵⁻⁷ and affect children born to mothers exposed to oil contaminated by PCB.⁸ They have also been found in the milk of nursing mothers in Michigan.⁹

Table 3 shows the estimated 50th percentile (median) and 90th percentile consumption levels of PCB for the white croaker and Pacific bonito. Data on PCB concentrations for bonito were obtained in 1975-77 by trawl in the relative area

Table 1a and 1b. Size of Population of Sportfishermen in Survey Sites.

a. Total Number of Fishermen Per Year by Frequency of Fishing

Frequency of Fishing	%	Number of Fishermen per Day	Coefficient	Number of Fishermen per Year
Infrequent (< 1 mo)	28	155	365/2	28,288
1 - 3 times/month	23	128	365/24	1,947
1 - 2 times/week	35	194	365/72	983
3 - 4 times/week	9	50	365/182	100
5 - 7 times/week	5	28	365/312	33
Total	100	555	-----	31,351

b. Total Number of Family Members Who Are Fish Eaters

Number of Family Fish Eaters	%	Total Number
0	2	0
1	20	6,270
2	26	16,303
3	13	12,227
4	14	17,557
5	11	17,243
6	6	11,286
7-20	8	20,064
Total	100	100,950

Table 2. Description of Primary Fish Kept by Sportfishermen

(n = 1,059)

Species	Percent of Fishermen Who Caught	Median Number (range)	Average (\pm sem) Weight (g)
White Croaker	34%	4 (1, 40)	153 \pm 3
Pacific Mackerel	25%	4 (1, 56)	334 \pm 9
Pacific Bonito	18%	2 (1, 55)	717 \pm 26
Queenfish	17%	2 (1, 100+)	143 \pm 5
Jacksmelt	13%	1 (1, 30)	223 \pm 8
Walleye Perch	10%	2 (1, 21)	115 \pm 5
Shiner Perch	7%	2 (1, 29)	54 \pm 5
Opaleye	6%	2 (1, 13)	307 \pm 38
Black Perch	5%	2 (1, 17)	196 \pm 14
Kelp Bass	5%	1 (1, 7)	440 \pm 61
California Halibut	4%	1 (1, 4)	1752 \pm 144
Shellfish*	3%	3 (1, 84)	421 \pm 124

* Crab (spider, red, yellow, rock), mussels, abalone.

of this survey.² Data on PCB concentrations for white croaker were recently reported by Young *et al.*³ from fish taken in the outer Los Angeles harbor region of Cabrillo Beach. Based on these data, which may not be accurate for fish consumed in the present study, the annual median level of PCBs for white croaker consumption would be 3.2 mg (14.8 g x 0.6 μ g/g x

365 days). Similarly, the annual median level of PCBs for bonito consumption would be 7.2 mg (63.6 g x 0.31 μ g/g x 365 days). However, if one considers the population of heavy fish eaters at the 90th percentile, the annual consumption of PCBs would be 18.7 mg for white croaker and 37.8 mg for bonito.

Recommendations

Despite what is known about the toxicity of PCBs, it is not yet possible to assign with any certainty a critical risk threshold. Therefore, the long-range public health significance of PCB contamination in humans remains unknown. We do feel, however, that sufficient data exist to warrant further studies. In particular, analyses of the twelve most prevalent fish being consumed should be undertaken to identify and quantify possible contaminants. The effect of cooking methods on PCB consumption level should also be examined. In addition, further work is needed to determine potential subpopulations at risk such as raw fish consumers, individuals over 65 years, Orientals and Samoans, and frequent fishermen at Site 8. In-depth health assessments of these subpopulations should then be conducted.

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Table 3a and 3b. Estimated Annual Consumption of PCB (mg)*

a. 50th Percentile

Species	Consumption Rate (g/day/person)	Concentration of PCB (µg/g)	Annual Consumption of PCB (mg)	Dose** µg/kg/day
White Croaker	14.8	0.60	3.2	0.13
Bonito	63.6	0.31	7.2	0.28

b. 90th Percentile

Species	Consumption Rate (g/day/person)	Concentration of PCB (µg/g)	Annual Consumption of PCB (mg)	Dose** µg/kg/day
White Croaker	85.2	0.60	18.7	0.73
Bonito	334.0	0.31	37.8	1.48

* Data are given for edible portion.

** Calculated as annual consumption x 1000/70 kilograms where 70 kg is the average adult weight.

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Robert Brice is the EPA Project Officer (see below).

The complete report, entitled "Consumption Rates of Potentially Hazardous Marine Fish Caught in the Metropolitan Los Angeles Area," (Order No. PB 82-229 493; Cost: \$7.50, subject to change) will be available only from:

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