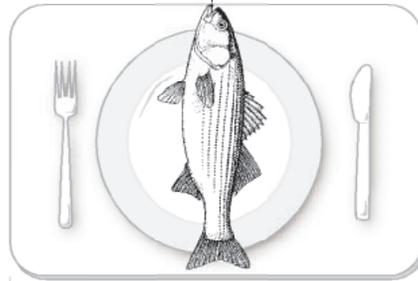
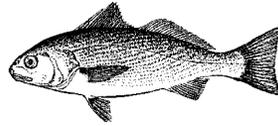


Public Summary
of the
**San Francisco Bay
Seafood Consumption Study**



March 2001



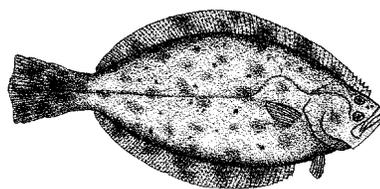


Because most fish in San Francisco Bay contain chemicals at levels that may be harmful to people who eat these fish regularly, the California Office of Environmental Health Hazard Assessment issued a health advisory in 1994. The advisory recommends that individuals limit the amount of fish they eat from the Bay and also suggests ways to prepare and eat Bay fish that lessen chemical exposure.

A partnership among a variety of government agencies and non-governmental organizations sponsored and oversaw this study to learn more about Bay anglers and their fish consumption practices, and compare the results to the recommendations of the health advisory. Information was collected by interviewing anglers in person.

Results indicate that the majority of people who eat fish from the Bay do so safely, without exceeding the health advisory recommendations. However, about one in ten eats more than the recommended amount. Among ethnic groups, Asian anglers stand out as a group of concern due to their large numbers, consumption rates, and methods of preparation and consumption.

These results suggest that current measures to make anglers aware of the advisory should be improved. All Bay anglers should be aware of the advisory. However, only about half of the anglers interviewed had heard or seen cautionary information regarding the consumption of Bay fish, and of those anglers, just half had specific knowledge of the contents of the advisory. Increased awareness can lead to safer consumption practices and reduce health risks to the angler population and others who eat Bay fish. Meanwhile, efforts to eliminate the underlying cause of fish contamination—contamination of the Bay—continue.



Public Summary
of the
San Francisco Bay
Seafood Consumption Study

March 2001

California Department of Health Services, Environmental Health Investigations Branch
Oakland, California

San Francisco Estuary Institute
Richmond, California

Table of Contents

Introduction	4
Collecting the data	4
Results	6
Interview success	6
Quantity of Bay fish consumed	6
Who is likely to eat above the advised amount?	6
Commonly consumed fish	8
Consumption of fish parts and preparation methods	9
Consumption of fish from places other than San Francisco Bay	10
Consumption by others in the angler household	10
Angler awareness of health advisory or related information	10
Changes in fishing habits due to advisory	10
Preferred methods for angler outreach	10
Conclusions	11
Recommendations	12
Recommendations for outreach and education activities	12
Recommendations for community involvement	13
Recommendations for further study	13

Some of the questions that this study was designed to answer include:

- How much Bay fish do anglers eat?
- What kinds of fish do anglers catch and eat?
- Are anglers aware of the current health advisory?

Study design

National and regional experts from a variety of relevant disciplines assisted in the design and review of this study. Information gathered in the Los Angeles area by the Santa Monica Bay Restoration Project and smaller-scale efforts by public interest groups in the San Francisco Bay Area were instrumental in the study design.

Introduction

Elevated levels of contaminants in fish from San Francisco Bay have raised concern for Bay anglers who consume these fish regularly. High levels of mercury and polychlorinated biphenyls (PCBs) in Bay fish led the state Office of Environmental Health Hazard Assessment to issue a health advisory recommending that individuals limit their Bay fish consumption. To learn more about San Francisco Bay anglers and their potential exposure to chemicals in Bay fish, the San Francisco Estuary Regional Monitoring Program and California Department of Health Services sponsored a survey of San Francisco Bay anglers and their fish consumption habits.

The goals of the San Francisco Bay Seafood Consumption Study were to

- Gather information on San Francisco Bay anglers and their fish consumption practices
- Identify anglers who are at risk due to their fish consumption habits
- Gather information to aid the development of effective educational messages about the consumption of fish from the Bay

This document summarizes results that are presented in greater detail in the study's *Technical Report*, available from the San Francisco Estuary Institute at (510) 231-9539 or www.sfei.org.

Collecting the data

Between July 1998 and June 1999, interviewers conducted over 150 fishing site visits and approached over 1,700 San Francisco Bay anglers. The sites chosen for interviews included 14 public piers and adjacent beaches or banks, five public boat launches, and party boats from three marinas (see figure 1). A total of five languages (English, Spanish, Vietnamese, Cantonese and Mandarin) were spoken among the ten interviewers of the study. Typically, a site was visited by a pair of interviewers, who attempted to interview all persons in possession of a fishing rod and over 18 years of age.

The survey included questions on ethnicity, income, education, age, amount of fish eaten, species of fish eaten, parts of fish eaten, preparation and cooking methods, others in the household who eat the catch, and awareness and knowledge of the state health advisory. The entire interview took about 20 minutes per angler. Angler fish-consumption rates were determined from responses regarding how often a meal of fish was eaten and the size of the meal. Interviewers displayed pictures of 13 Bay fish species and 3 shellfish species and asked anglers how many times they had eaten each in the last four weeks—a time period within which anglers were assumed to have reasonably accurate recall. Responses for meal size were aided by the presentation of a plastic model of an eight-ounce fish fillet.

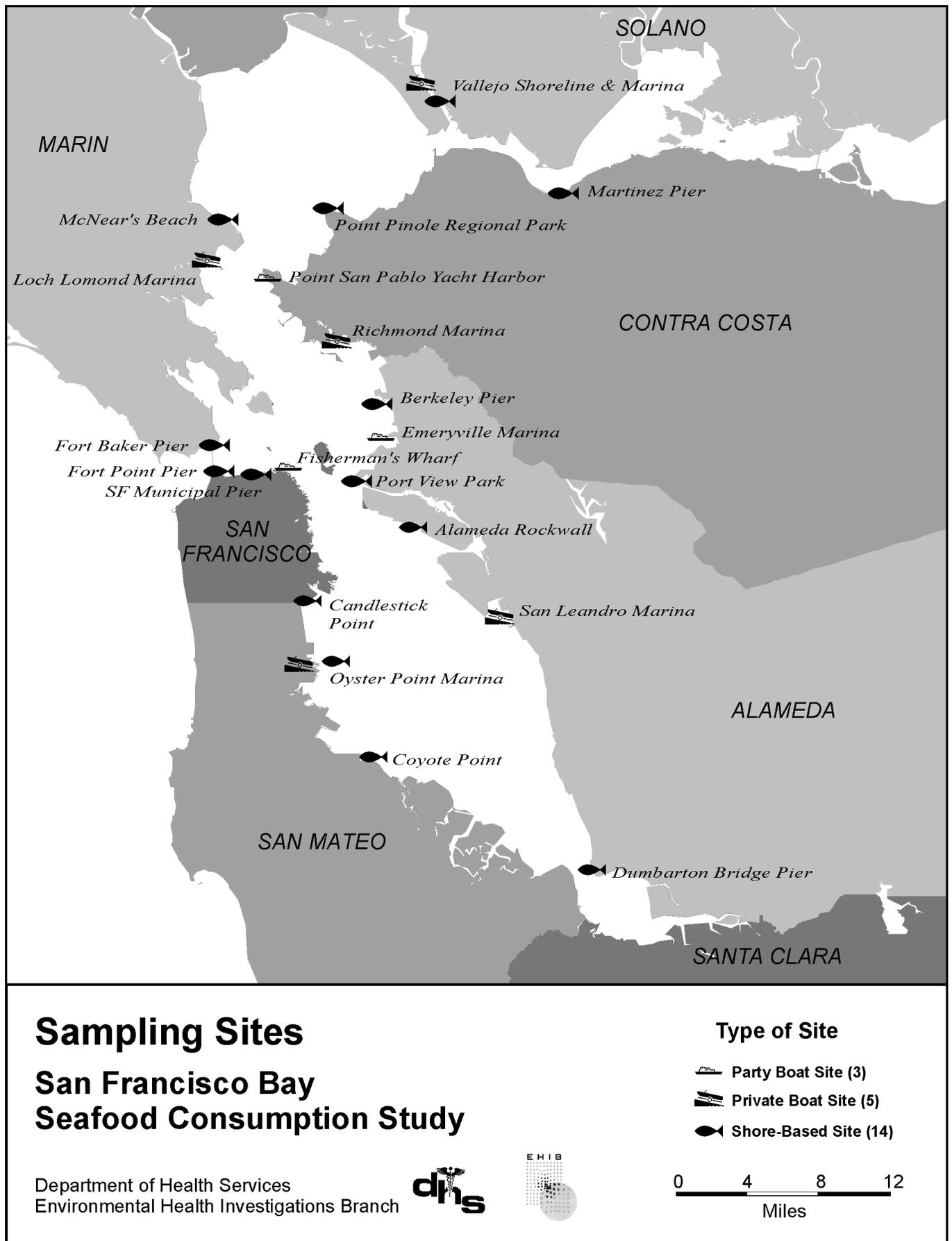


Figure 1

The largest consumption study in Northern California to date

Having interviewed more than 1,300 anglers—far more than any other study in this region—gives us the best picture of seafood consumption in the Bay Area thus far. Anglers were interviewed from Fremont to Martinez, and San Mateo to Vallejo. For the first time, we are beginning to identify the anglers eating contaminated fish above recommended amounts, allowing us to develop more effective educational messages for them.

The health advisory

The health advisory issued by the California Office of Environmental Health Hazard Assessment recommends that anglers consume no more than two meals of fish from San Francisco Bay per month.* Nursing women, women who are or may become pregnant, and children under six years of age are advised to consume no more than one meal per month. The advisory defines meal size based on body weight—roughly one ounce of uncooked fish per 20 pounds of body weight. For example, a meal for a person weighing 154 pounds is eight ounces. For a 40 pound child, the meal size is two ounces.

*Note that the advisory does not apply to salmon, anchovies, herring, and smelt. In this study these fish were excluded from the consumption values that were compared to the advisory.

Results

Interview success

Over 1,300 anglers, three-quarters of those approached, agreed to be interviewed (see figure 2). The participation rate was higher than that of comparable studies, such as one done in Santa Monica Bay in 1992. This large sample size and the way interviews were obtained made the results as representative of the overall angler population as possible.

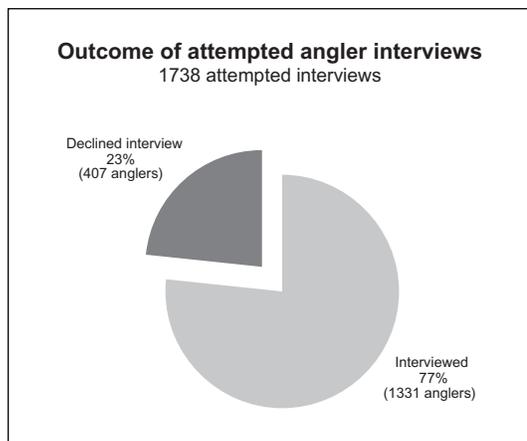


Figure 2

Quantity of Bay fish consumed

When asked about their recent Bay fish consumption, anglers' responses ranged from no consumption to the equivalent of an 8-ounce meal of Bay fish every day. About 15% of anglers reported eating no Bay fish at all. Of the fish-consuming anglers, responses regarding consumption in the last four weeks indicated that about eight out of ten eat the equivalent of one meal a month or less, about one in ten eats roughly two meals a month, and another one in ten eats more than two meals a month. A point of reference for angler fish consumption rates is provided by the fish consumption health advisory (see sidebar). Study results indicate about one in ten fish-consuming Bay anglers eats over the advisory level. Among those eating over the advisory level, about two-thirds are eating twice the advisory level or more (see figure 3).

Who is likely to eat above the advised amount?

Anglers' likelihood of eating over the advisory limit varied with ethnicity, with Asians and African Americans more likely than other ethnic groups to eat above the limit (see figure 4). Differences in income, education, or fishing mode did not markedly change anglers' likelihood of eating over the advisory limit.

African Americans and Filipinos reported higher overall consumption than Caucasians (see figure 5). The average consumption rates among

Angler consumption relative to the health advisory

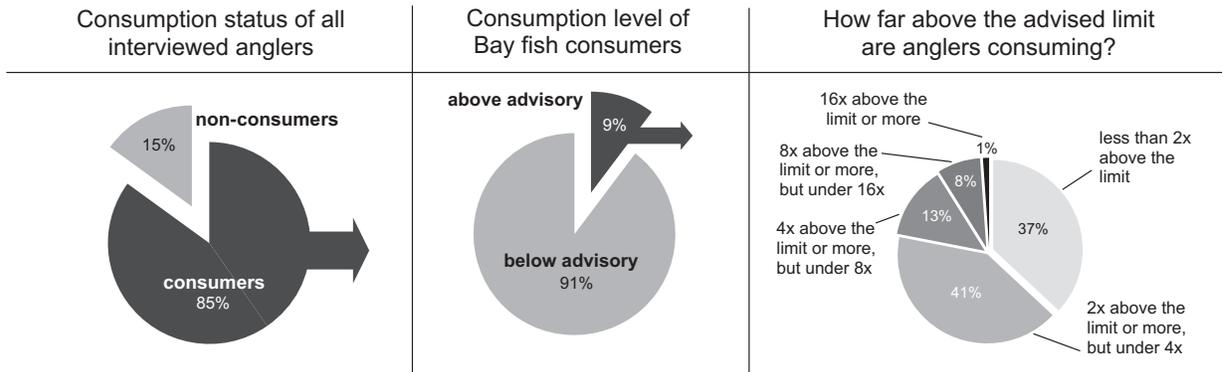
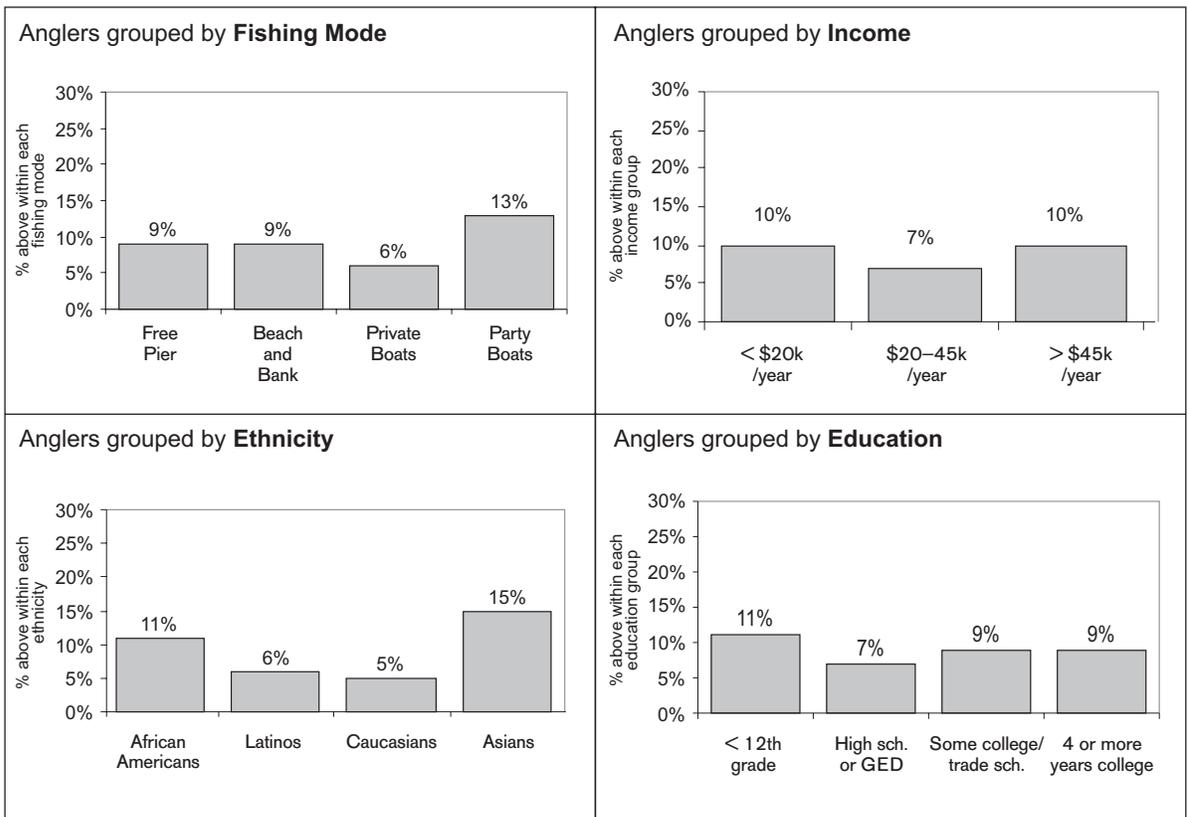


Figure 3

Percentage of anglers consuming above advisory recommendations Anglers with Bay fish consumption



Anglers with no fish consumption excluded from percentage calculations.

Figure 4

Avidity bias

In this study, the interview team interviewed those anglers who happened to be present at the time and place where the team was working. Understandably, an angler who fishes every day was more likely to be interviewed than one who fishes once a month. However, both these anglers are part of the Bay angler population and deserve equal representation in the study. To compensate for the over-representation of those who fish more frequently (a phenomenon called *avidity bias* by surveying experts), anglers were asked how often they fished, and study results were adjusted based on the responses, giving less weight to frequent anglers and more to those who fish less frequently. All numbers in this summary are adjusted for avidity bias, excepting those in figure 7. More information on the avidity bias adjustment can be found in the study's *Technical Report*.

other ethnic groups were not statistically different, however, comparisons were hampered in some cases by small group sizes (e.g. Pacific Islanders).

Commonly consumed fish

The five most popular fishes eaten by anglers with recent Bay fish consumption were striped bass, halibut, jacksmelt, sturgeon, and white croaker, in that order. These five species are all currently being monitored for contaminants by the Regional Monitoring Program. Striped bass was by far the most popular, with over twice the angler share than the next most popular fish, halibut (see figure 6). These results were probably influenced by the abundance of each species during the period of interviews. This abundance can vary significantly from year to year. Striped bass were particularly abundant in 1998, although other surveys have shown this species to be popular regardless of abundance.

The popularity of a fish often varied depending on the angler's fishing mode, ethnicity, income, and education. For example, Asians and people of lower income or education were more likely than other groups to consume white croaker (see figure 7), a fish of particular concern due to high contamination levels.

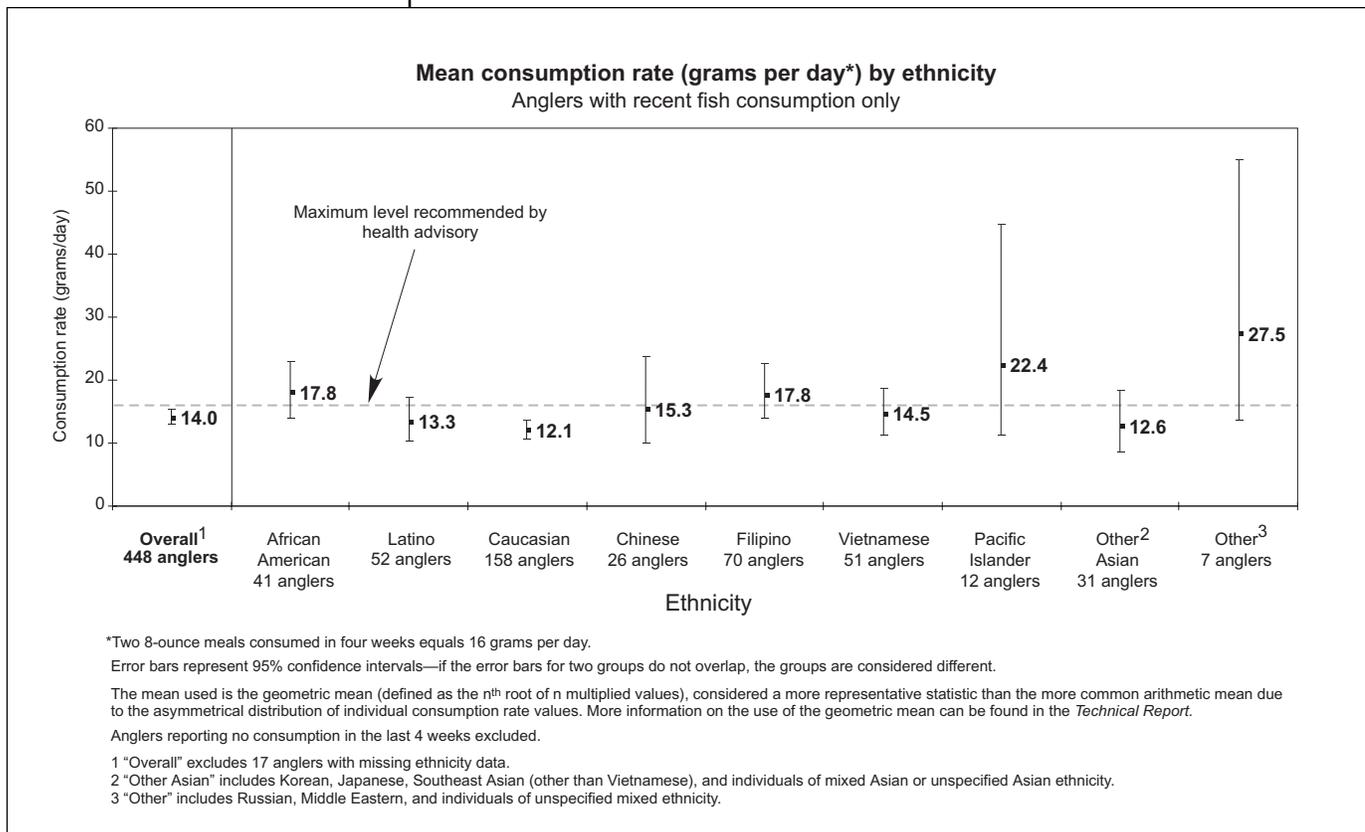


Figure 5

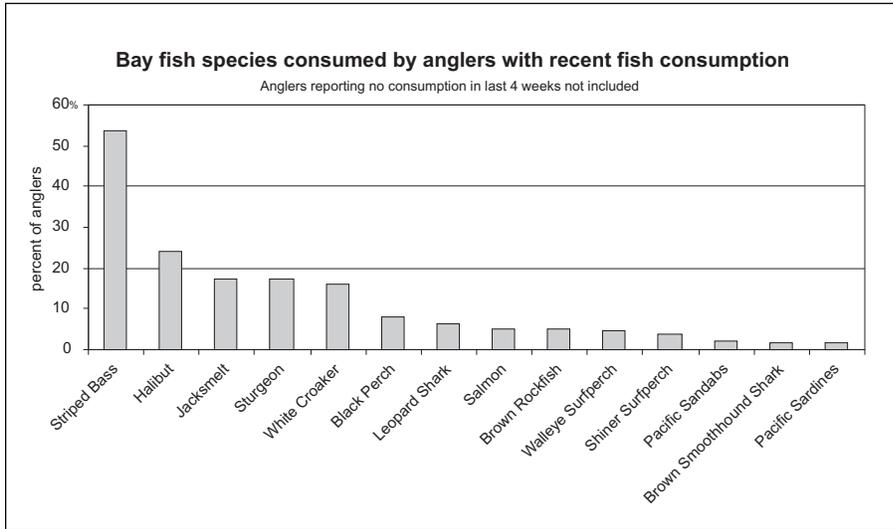


Figure 6

Consumption of fish parts and preparation methods

Some contaminants in fish, such as PCBs and pesticides, concentrate in fatty tissues, such as the skin and internal organs. Fish parts consumption and fish preparation practices may have a considerable impact on angler exposure to these types of contaminants.

For some of the commonly consumed fishes, Asian anglers were found more likely than other ethnic groups to eat the skin of the fish, eat the cooking juices, and eat the fish raw or in soup, all of which increase their exposure to contaminants. Skin consumption was also more frequent with shore-based anglers and anglers of lower income and education.

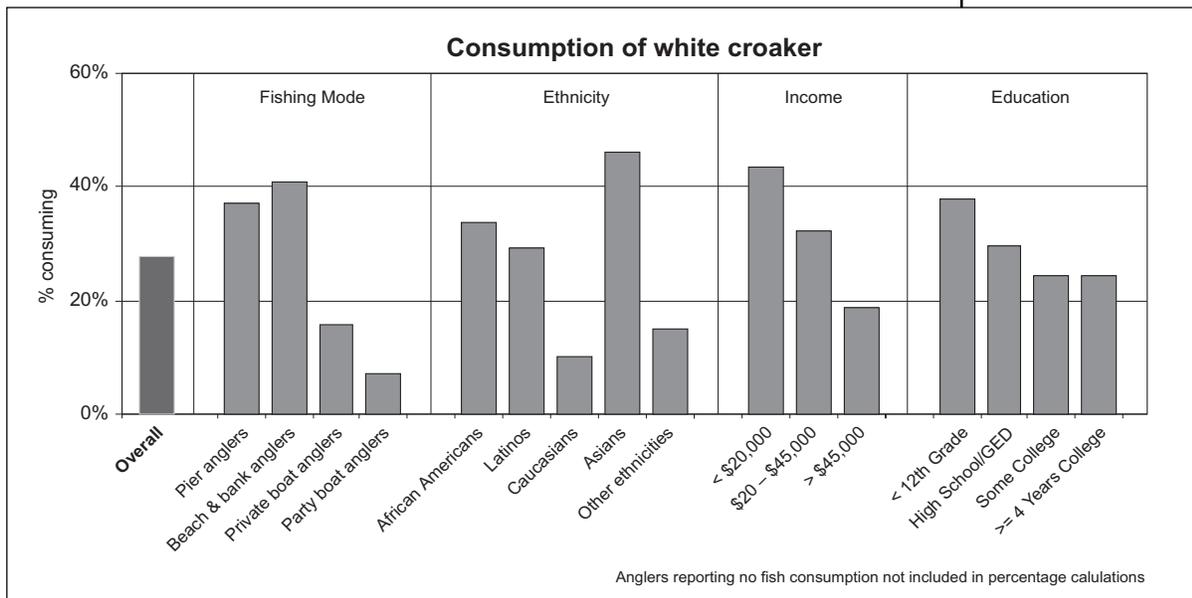


Figure 7

Consumption of fish from places other than San Francisco Bay

About a fifth of all anglers reported eating fish they caught from places other than San Francisco Bay, such as the ocean. About half indicated they eat fish from stores or restaurants. On average, anglers who ate Bay fish in the last four weeks also ate one meal of fish from these other sources.

Consumption by others in the angler household

Many anglers reported that other household members ate some of the fish they caught from San Francisco Bay. About 40% reported women of childbearing age eat some of the fish they catch (In addition, about 5% of the fish-consuming anglers interviewed were themselves women of childbearing age). About 11% reported that children under the age of six eat the fish they catch, and 2% reported that pregnant or breastfeeding women eat a portion of their catch. Shore-based anglers were more likely to have fish-consuming household members than boat anglers.

Determining the amount of fish eaten by others in angler households was beyond the scope of this study.

Angler awareness of health advisory or related information

Of those interviewed, 61% said they had “heard or seen ... information or health advisories about eating fish from the Bay.” However, only about half of these anglers could recall specific health protective recommendations for eating Bay fish (see figure 8). Anglers with high education or household income were more likely to recall specific health protective recommendations, but these anglers were not found to eat less fish than other anglers.

Changes in fishing habits due to advisory

About one-third of those who had heard or seen cautionary information said they changed their behavior because of that awareness. Of anglers that do not eat the fish they catch, about two out of ten said they discontinued eating Bay fish because of information regarding contamination. No significant difference was found between the overall consumption rate of those who were aware of cautionary information and those who were not.

Preferred methods for angler outreach

During the interview, anglers were asked how they preferred to receive information regarding fish consumption advisories. Newspapers and television were the leading preferred methods, followed by fishing-site signs, friends and family, and text in the fishing regulations pamphlet. Although newspapers and television were the most popular, each were cited by only 35% of the anglers, indicating a variety of approaches is necessary to reach all anglers.

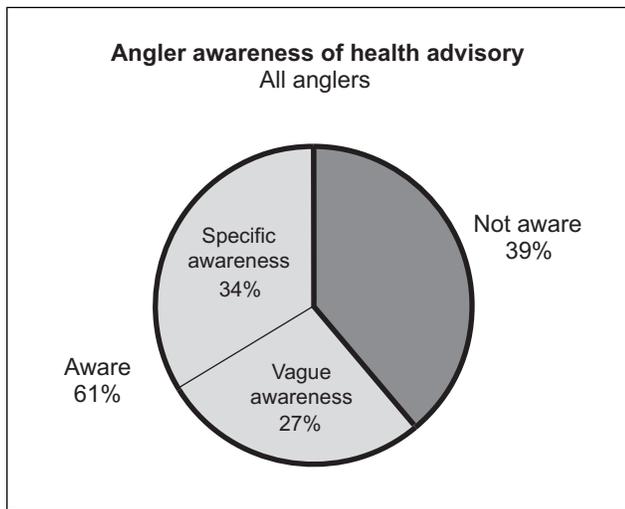


Figure 8

Conclusions

The fact that the vast majority of San Francisco Bay anglers is eating within the limit recommended by the state health advisory is good news. Although fewer than one in ten anglers are eating above the advisory, these anglers remain cause for concern.

Among ethnic groups, Asian and African-American anglers appear to be at greatest risk for chemical exposure. Asians are most likely to eat over the advised limit, and most likely to eat white croaker, which has been found to contain the highest amounts of organic contaminants (such as DDT and PCBs) among the seven fish species monitored by the Regional Monitoring Program. In addition, for some commonly consumed fishes, Asian anglers are most likely to eat the fish raw, eat the skin, and eat the juices released during cooking, all of which increase exposure to organic contaminants. Among Asians, Filipinos often had the highest-risk consumption practices. African Americans share many of the same high-risk consumption practices as Asians, though typically to a lesser extent.

For angler exposure to fish contaminants to be reduced, either anglers must change their consumption habits, or the contamination of the fish must be reduced. The Bay environmental management community is pursuing the latter as a long term goal. Currently one of the most important efforts involves cleanup plans known as Total Maximum Daily Loads (TMDLs). However, Bay contamination is widespread and persistent, and new contaminants may lead to new problems. Even under the best circumstances significant decreases will take many years. Meanwhile, anglers should make informed decisions regarding their consumption habits. Certainly, information about the advisory and safer cooking and eating practices should be made available and accessible to all anglers. With 40% of the fishing population having no knowledge of the advisory at all, outreach and education need to be improved.

Recommendations

Additional information about these recommendations is provided in the *Seafood Consumption Study Technical Report*, available at www.sfei.org.

Recommendations for outreach and education activities

- *Conduct outreach and education activities to reach highly exposed groups*

Asians, particularly Filipinos, were found to be at greatest risk from chemical exposure. In addition, African Americans had high overall rates of Bay fish consumption. Messages should be developed specifically for these groups.

- *Deliver educational messages using a variety of approaches*

Because none of the methods of delivering educational information to anglers received overwhelming support by all anglers, a diversity of approaches, including newspaper, television, radio, and written materials, would be most effective.

- *Develop educational messages that are culturally appropriate*

Given the ethnic diversity of Bay anglers, we recommend that educational messages be multilingual, sensitive to ethnic and cultural differences, and appropriate to the angler's literacy level.

- *Develop educational messages that address specific consumption practices*

There are clear differences among anglers in the species and parts of fish that they eat, and in how the fish are prepared or cooked. Educational messages should address these differences. For example, messages for Asians should focus on safer ways to prepare and eat fish and on limiting or eliminating white croaker consumption.

- *Develop educational messages that reflect the current advisory*

Although an update to the advisory is in preparation, all educational messages should convey the content of the current advisory until the update is complete.

- *Post warning signs in all areas of San Francisco Bay*

Signs are the most direct way to reach anglers. Multilingual signs warning anglers about contaminants in Bay fish should be posted and maintained at angling sites throughout the Bay.

- *Direct the existing Education and Outreach Task Force to take a leadership role in educational activities*

A major barrier to sign posting and other educational activities in the Bay Area has been uncertainty over which organization has jurisdiction. For example, it is often unclear who should post and maintain a warning sign at a pier. To overcome this problem, an existing group that represents a number of agencies and interest groups, the Education and Outreach Task Force on Fish Consumption and Fish Contamination Issues, should be given increased authority and resources to coordinate and conduct fish consumption education.

Recommendations for community involvement

- *Expand the membership of the Education and Outreach Task Force to have broader community representation*

To be successful, the Task Force must more closely reflect the diverse angler population. The Task Force should seek broader representation from community-based organizations that represent health care, environmental, fishing, and other pertinent interests in the Bay Area.

- *Conduct activities that enhance participation from community-based organizations*

We recommend that the Task Force undertake activities that will enhance participation and support from community-based organizations.

Recommendations for further study

- *Test the effectiveness of educational messages and activities*

Data on the effectiveness of messages and their method of distribution are lacking. The comprehension and effectiveness of educational messages should be studied.

- *Gather additional data on angler household members who consume Bay fish*

A significant number of women of childbearing age and small children in angler households consume Bay fish. These individuals are more sensitive to the harmful effects of fish contaminants. We need more information on these consumers and how to develop educational messages to reach them.

- *Gather additional data on shellfish consumers in San Francisco Bay*

Because Bay shellfish may pose health risks to people who consume it, more information on shellfish consumers in the Bay is needed.

- *Gather additional data on party boat anglers in San Francisco Bay*

The number of party boat anglers in this study was lower than specified in the study design. Additional data on party boat anglers should be gathered to better characterize their consumption rates and practices.