

**HUMAN EXPOSURE TO TOXIC CHEMICALS
THROUGH SUBSISTENCE SHELLFISHING
IN CASCO BAY**

Prepared for:

The Casco Bay Estuary Project

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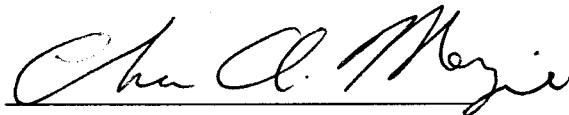
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EXECUTIVE SUMMARY

This study evaluates whether people are eating shellfish from polluted areas identified by the Casco Bay Estuary Project and the Maine Department of Environmental Protection. It is designed to:

determine if people are harvesting shellfish in areas where chemical contamination is known to exist;

determine general shellfishing and fishing activities that people engage in that might provide insight into potential exposure through seafood ingestion; and,

determine the amount of locally-harvested shellfish in the diet.

The first two objectives were met. Preliminary information was developed on amounts of locally harvested shellfish in the diet of one , specific population. However, the sample size was small and should not be relied upon for quantitative estimates of exposure or risk..

Geographic Focus of the Study

We identified areas where chemical concentrations in blue mussels exceed the state's health-protective action levels (see Table ES-1 Figures 1 to 7). These areas were the focus of the study.

Table ES-1. Locations in Casco Bay Where Blue Mussel Concentrations Exceed Chemical Residue Action Levels

Sampling location	Chemicals Exceeding Action Levels
Back Cove, Portland	Lead, Dioxin TEQ, Total PCBs
Punchbowl at Jewell Island	Arsenic, Dioxin TEQ
Harraseeket River, Freeport	Dioxin TEQ
Wolfe's Neck Woods State Park, Freeport	Dioxin TEQ
Quahog Bay, Harpswell	Total PCBs
The Basin, Phippsburg	Dioxin TEQ, Total PCBs
Falmouth	Arsenic, Total PCBs
Middle Bay, Brunswick	--none--

Population Focus

We gathered information about shellfishing activity among the general population of recreational shellfishers for the areas listed in Table ES-1. In addition, we collected information on the shellfishing and fishing activities of Portland's Southeast Asian community. The rationale for including the Southeast Asian community in our study was that members of this population might be engaging in shellfishing more frequently and nearer to Portland where some areas are known to be contaminated.

Shellfishing and Fishing by the General Population in Casco Bay

Recreational fishing and/or shellfishing commonly occurs in the following areas, according to Shellfish Wardens, Marine Patrol officers, and local environmental groups:

Little River, Wolfe's Neck Woods State Park, Harraseeket River and Winslow Park in Freeport

Middle Bay in Brunswick

Strawberry Creek and Quahog Bay in Harpswell

The Basin, Hermit Island, Atkins Bay and Mill Dam in Phippsburg

New Meadows River and Back Cove in West Bath

Back Cove, the State Pier, the Fore River, East End Beach/Eastern Promenade and around the Casco Bay Bridge in Portland

Riverton Trolley Park on the Presumpscot River (freshwater)

Martin Point Bridge in Falmouth

Jewell Island, Cliff Island, Peaks Island, Chebeague Island, Little Diamond Island, Great Diamond Island and Cousins Island in Casco Bay.

These areas, which include some of the areas identified as being of potential concern, are shown in Figure 11. Observations made during the summer of 2001 confirmed information obtained from the Shellfish Wardens in Freeport, Harpswell and Phippsburg about the level of commercial vs. recreational shellfish harvesting. The following conclusions were reached:

Shellfishing occurs throughout Casco Bay. The areas identified by the Shellfish Council and Marine Patrol as "most popular" for recreational shellfishing were: The Harraseeket River and Wolfe's Neck Woods State Park in Freeport; The Basin and Hermit Island in Phippsburg; Strawberry Creek in Harpswell; Sandy Point and Sea Meadows on Cousins Island and the Old Town Landing in Yarmouth.

Shellfishing in Back Cove and other more highly polluted areas appears limited. At most, this has been observed a “handful of times.”

Shellfishing does take place in areas where elevated levels of contaminants have been observed in mussels. Individuals engaging in shellfishing activity in these areas appear to be mostly white males and sometimes families. Southeast Asians and other minority groups do not comprise an obvious higher proportion of people engaged in this activity. Currently, the Southeast Asian and other minority groups comprise only a small fraction of the population in Cumberland County.

However, the size of these populations may be expected to increase substantially in the future due to State refugee resettlement efforts.

Shellfishing and Fishing by Members of the Southeast Asian Community in Portland

A mail survey and telephone survey was undertaken with the aid of members of the Southeast Asian community. The response rate was low: 16 mail survey forms were returned and 35 telephone interviews were completed. Therefore, information obtained provides preliminary insights but should not be used to quantify exposure for the Southeast Asian community as a whole. Insights reached are:

Members of the Southeast Asian community who are engaged in shellfishing or fishing activity may do so up to three times a week. A more comprehensive survey might broaden this range. Recreational shellfishing is more common in the warmer months of the year.

The frequency of local seafood harvesting activity by mail and telephone survey respondents is high (56 – 70%). Most of the locally-caught seafood eaten is comprised of fish, primarily mackerel and striped bass. Clams, mussels, other mollusks and crabs are also eaten.

The preliminary estimate of the amount of locally-caught seafood eaten by members of this community is likely to embrace a broad range, overlapping with that of the general population in Maine, but including individuals who rely on locally-caught fish and shellfish as an important source of food. More comprehensive surveys are likely to broaden the range in consumption rates and provide more definition for the statistical tails of consumption rates among the Southeast Asian community.

As is the case for the general shellfishing population, shellfishing and fishing activity by the Southeast Asian community is not localized, but spread out over greater Portland. Use of boats for these activities by Southeast Asians is not widespread, but more common than anticipated.

The Southeast Asian community in Portland is currently relatively small and diffuse. However, such communities can serve as anchors that promote further settlement. Thus, it is possible that this community will continue to grow. Because a high fraction of individuals in the community fish and shellfish, it is possible that increased activity around Portland would be observed in the future.

1.0 INTRODUCTION

The purpose of this study, *Human Exposure to Toxic Chemicals Through Subsistence Shellfishing in Casco Bay*, is to evaluate whether people are eating shellfish from polluted areas identified by the Casco Bay Estuary Project and the Maine Department of Environmental Protection. We are interested in determining the extent to which recreational shellfishing is occurring, particularly if subsistence shellfishing/fishing is occurring, in these areas. The use of the term “subsistence” reflects the possibility that some members of the population rely on shellfish as an important component of their diet. Because shellfish – such as clams and mussels – can accumulate chemicals such as pesticides and metals, eating these shellfish results in chemical exposures. While the current study does not quantify such risks, it does provide information useful for judging exposure. Our study objectives are to:

- determine if people are harvesting shellfish in areas where chemical contamination is known to exist;

- determine general shellfishing and fishing activities that people engage in that might provide insight into potential exposure; and,

- determine the amount of locally-harvested shellfish in the diet.

With respect to these objectives, we were able to address the first two. We did develop preliminary information on amounts of locally harvested shellfish in the diet of one, specific population. However, the sample size was small and should not be relied upon for quantitative estimates of exposure or risk.

Experience in other coastal areas of the United States has revealed that recently settled populations of Southeast Asians are more likely to engage in local shellfishing (and perhaps fishing) practices and may use areas that other members of the population recognize as polluted (Charles and Menzie, 1998). This can occur for cultural reasons, to supplement the diet, and because recently settled populations are less aware of the potential pollution hazards associated with particular areas. Because English is not a primary language, communication methods that work for the general population may not be effective. For these reasons, this study focuses on the recent settlement communities of Southeast Asians in Portland, Maine. While we are most interested in the extent to which members of this community use local shellfish as a source of food, we also gathered information on how they use the fishery resources of Casco Bay. This broader data gathering effort helps provide perspective on the extent to which they need to rely on local shellfish as a source of food.

Because the project focuses on a particular segment of the population – the Southeast Asian community – it is important to develop a better understanding of this community and to establish communication with members of the community. We used such information to develop surveys (telephone and mail), to identify potential trends in population growth, and to examine spatial relationships among community locations, contaminated areas, and areas sought for shellfishing and fishing.

Our report is organized into 7 chapters. Chapters 2 and 3 describe the coastal areas that were the primary focus of our data collection efforts, provide background on geographical considerations and provide a socioeconomic overview of the Southeast Asian population of Portland. We used this information to design the telephone and mail surveys and it gives insight into population size and trends. It should be viewed as an important background piece for understanding the data gathering efforts. Chapter 4 provides field observational information on shellfishing practices. Chapter 5 summarizes the methods used and results of our survey of shellfish activity and consumption by the Southeast Asian community in Portland. Conclusions are provided in Chapter 6. Chapter 7 provides the cited references.

2.0 GEOGRAPHIC AREAS OF INTEREST

2.1 Overview

In 1990, Casco Bay was designated as an “estuary of national significance” and included in the U.S. Environmental Protection Agency’s National Estuary Program. The National Estuary Program was established in 1987 to protect nationally significant estuaries threatened by pollution, development, or overuse. As a result of this designation, the Casco Bay Estuary Project (CBEP) was formed with the mission of preserving the ecological integrity of Casco Bay and ensuring compatible human uses of the Bay’s resources through public stewardship and effective management. One of the five goals identified by CBEP is to “reduce toxic pollution in Casco Bay.” CBEP is monitoring progress towards this goal by testing for the presence of toxic contaminants in mussel tissue, lobster meat and tomalley and sediment.

In 1991 and 1994, the CBEP funded comprehensive sampling of contaminants in surface sediments of the Bay. In 1991, samples were analyzed for metals, PAHs, pesticides, and PCBs. In 1994, butyltins, dioxins/furans and coplanar PCBs were tested. Results show that concentrations of contaminants tend to decrease with distance from the densely populated area around Portland. However, other parts of the Bay have levels of PAHs, cadmium, lead, silver, zinc, mercury, and PCBs (at one site) that are comparable to other contaminated estuaries in the U.S. (CBEP, 1996).

As a follow up to sediment testing, blue mussel (*Mytilus edulis*) tissue was tested for toxics at various locations around the Bay. The primary objectives of the mussel testing being conducted by the CBEP are to assess the environmental quality of the Bay, to establish trends of contaminants in blue mussels, and to evaluate the human health risks. Maine has historically ranked first in mussels harvested and Casco Bay is one of the most productive areas for wild mussels. Because mussels are widely harvested in the Bay, the health risk associated with human consumption is of great interest to the CBEP. Lead, PAHs, PCBs and dioxins and furan concentrations in mussel tissue were above Maine health “action levels” for shellfish at various locations in the Bay.

2.2 Identifying Coastal Locations of Potential Concern

We identified areas where chemical concentrations in blue mussels exceed the state’s health-protective action levels. Mussels are filter feeders and represent other bivalves (e.g., clams) that filter feed. In 1996, the Casco Bay Estuary Project sampled blue mussels in Back Cove in Portland, the Punchbowl at Jewell Island, the Harraseeket River in Freeport and Quahog Bay in Harpswell. In 1998, the CBEP collected mussel samples at four additional locations: Middle Bay in Brunswick, Freeport (next to Wolfe’s Neck Woods State Park), Falmouth and The Basin in Phippsburg. Concentrations of 12 metals, 11 pesticides, polychlorinated dibenzo-p-dioxins and dibenzofurans, polychlorinated biphenyls (total and coplanar congeners) and polycyclic aromatic hydrocarbons were measured. Figures 1 through 7 show the mussel sampling locations along with classification of adjacent coastal areas based on water quality monitoring for bacterial contamination (as of December 2000).

In 1999, the Maine State Toxicologist evaluated whether consumption of recreationally harvested mussels might result in a significant health risk due to chemicals in the mussels' tissues. Action levels for chemicals in tissue were derived following Maine Bureau of Health and United States Environmental Protection Agency (USEPA) procedures. These action levels were set so that consumption of one 8-ounce shellfish meal per week would result in minimal health risk. The action levels were then compared to the mean concentration and the 95th percentile upper confidence limit (95% UCL) on the mean concentration measured in mussel tissue for each chemical (Smith, 1999). The following table summarizes the compounds with concentrations that exceeded action levels based on the 1996 and 1998 sampling efforts.

Table 1. Locations in Casco Bay Where Blue Mussel Concentrations Exceed Chemical Residue Action Levels

Sampling location	Chemicals Exceeding Action Levels
Back Cove, Portland	Lead, Dioxin TEQ, Total PCBs
Punchbowl at Jewell Island	Arsenic, Dioxin TEQ
Harraseeket River, Freeport	Dioxin TEQ
Wolfe's Neck Woods State Park, Freeport	Dioxin TEQ
Quahog Bay, Harpswell	Total PCBs
The Basin, Phippsburg	Dioxin TEQ, Total PCBs
Falmouth	Arsenic, Total PCBs
Middle Bay, Brunswick	--none--

We selected these areas as geographic starting points for our evaluation and sought to determine the extent to which these areas were used for shellfishing.

3.0 POPULATION(S) OF INTEREST

3.1 Overview

Shellfishing is a local tradition for many Maine residents and for others it is their livelihood. Some groups of people may be more likely to shellfish than other groups based on their cultural experience or perhaps their economic status. By examining shellfishing activity among these groups, insight can be gained on whether unacceptable exposures might be occurring. Based on information from other areas, as reported in Charles and Menzie (1998), recently settled communities might frequently engage in shellfishing activities. Charles and Menzie (1998) observed that Southeast Asian immigrant populations in Massachusetts viewed shellfishing as a normal recreational and food-gathering activity that is consistent with their cultural experience. For this reason, we focused on the Southeast Asian community of Portland when developing estimates of locally-harvested seafood in the diet.

We collected demographic and ethnographic data on the Portland Southeast Asian community from the 1990 and 2000 U.S. Census for Cumberland County. We also contacted Catholic Charities and other organizations that assist refugee and immigrant populations in Portland. We examined the population structure of Cumberland County with respect to indices such as race, income, family structure and education. We expect that these characteristics might influence the recreational, dietary and social choices this group might make.

3.2 Demography of Cumberland County, Maine

The April 1, 2000 U.S. Census counted 265,612 people in Cumberland County, Maine. Census validation studies have consistently found that these counts slightly underestimate the true population, and that minorities, the poor, and those with limited education or English language skills are most likely to be missed by the counts. Our project relies on unadjusted Census data¹, and thus slightly underestimates both the total population of the county and its minority composition.

The official Census count represents an 8% increase over the census of 1990. The minority population grew significantly more rapidly: those classifying themselves as Black or African American increased by 80%. The number of Asians increased by 76%, and Native Americans increased by 21%. Even with these increases, however, Cumberland County remains an overwhelmingly (95.7%) white community. This composition is about the same as the rest of Maine, but far different from the nation as a whole, where 18% of the population classify themselves as nonwhite, and 11% are Hispanic (of any race).

¹ Adjusted data were not available in time for inclusion in this report.

Table 2. Race and Ethnicity of Cumberland County Residents, 2000

Total population	265,612	100.0%
One race	262,598	98.9%
White	254,291	95.7%
Black or African American	2,815	1.1%
American Indian and Alaska Native	763	0.3%
Asian	3,707	1.4%
Other	1,022	0.4%
Two or more races	2,411	0.9%
Hispanic or Latino ^a	2,526	1.0%

^a Hispanics may be of any race.

The largest identifiable minority group (Asians) makes up only 1.4% of the county's population (Table 2) and this group is internally fragmented. The largest category, nearly 1,000 persons -- a quarter of all Asians -- consists of ethnic groups the Census classifies only as "Other Asians." Of those with specific national classifications, Vietnamese (22%) and Chinese (17%) form the largest groups, with South Asians (including Cambodians, East Indians, Thai, etc), Filipinos, Koreans and Japanese forming tiny subminorities within the group (Table 3). The Asian population is concentrated within a few square miles around Casco Bay (Figure 8).

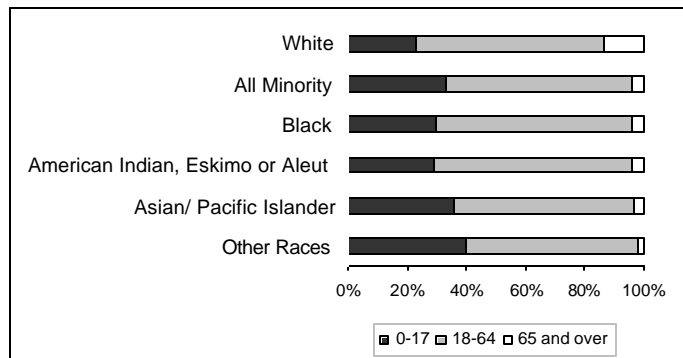
Table 3. Asian Population of Cumberland County, 2000

Asian	3,707	100%
Vietnamese	799	22%
Chinese	640	17%
Asian Indian	407	11%
Filipino	352	9%
Korean	292	8%
Japanese	173	5%
Other Asian category	976	26%
Two or more Asian categories	68	2%

African Americans are the only other minority exceeding one percent of the Cumberland County population. Their locations also are concentrated in a relatively small part of the county. The Hispanic and Native American populations are more dispersed (Figure 9) with a significant secondary Hispanic population in Brunswick (North of Casco Bay) and low concentrations of Native Americans throughout the county.

Age Structure

Every minority group in the county has more young and fewer old members than the white population². Thirteen percent of the white population, but only three percent of non-whites, are 65 or older. Fewer than a quarter of whites are under the age of 18, while 35% of Asians (and 40% of those classified as “other” races) are younger than 18.

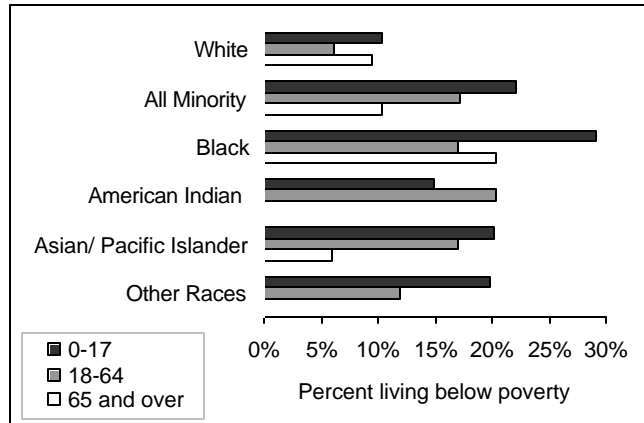


² As of November 1, 2001, the Census had not released detailed data on the characteristics of the Cumberland County population. The following analyses are based on 1990 data.

Poverty

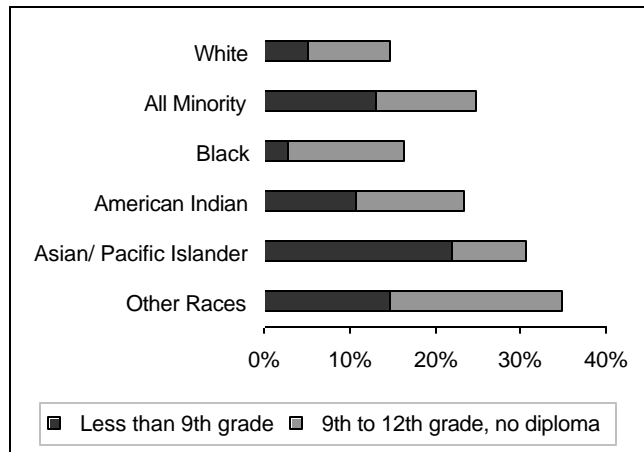
Thirty percent of the black children in Cumberland County live below the federally defined poverty level. This is three times the rate for white children, and five times the rate for white adults. Minority adults are also nearly three times as likely (17% vs. 6%) to live in poverty as white adults. Adult poverty is

slightly more prevalent among Native Americans than among other minority groups, but all are significantly poorer than whites. In the whole of Cumberland County only 164 minority people are older than 64. About a tenth of these – the same rate as among elderly white residents of the county – live in poverty.



Education

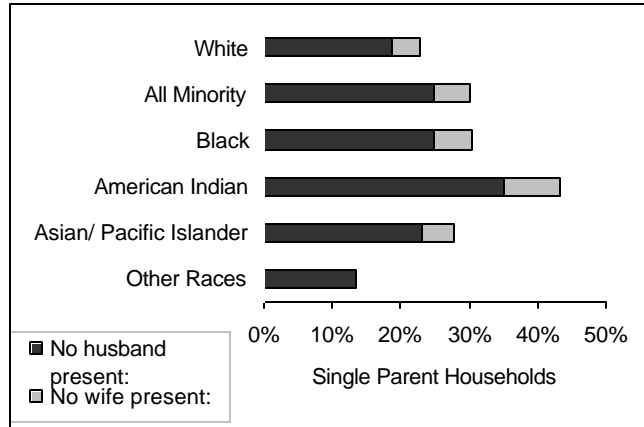
Fifteen percent of white and 16% of black residents over the age of 25 left school before receiving a high school diploma or the equivalent. Among other minorities, the drop-out rate was considerably higher, with 23% of adult Native Americans, 31% of Asians, and 35% of other race groups never having finished high school. Fully one fifth of Asian adults have less than a 9th grade education. This means that there were (in 1990) 234 Asians with at most an elementary education.



Family structure

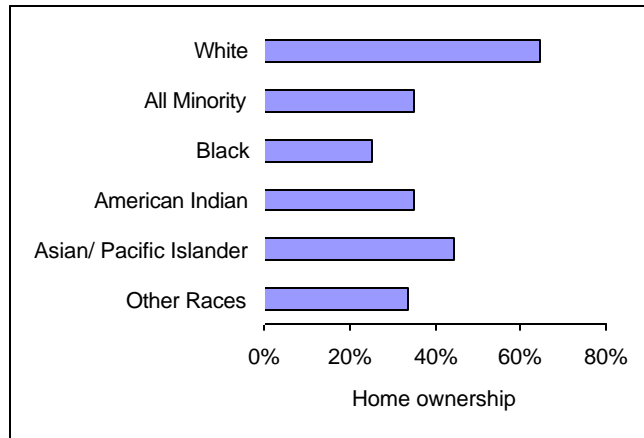
One third of the 96,000 households in Cumberland County include at least one child. Nearly half (46%) of minority households³ have at least one child, with 57% of Asian households listing at least one child under the age of 18. Most of these households with children include two adults, but 23% of white households and 30% of minority households do not. When only one

adult is present, it is usually (82% of the time) the mother. Native American households are most likely to lack one parent. More than one-third of Native American households with children are headed by women, and another 8% have a father but no mother present.



Home ownership

White families are about twice as likely to own their own homes as minority families. Nearly two-thirds (65%) of white homes are owner-occupied, compared with 25% of black homes and 35% of Native American homes. Asians are slightly more likely to be homeowners (45%), but the ownership rate still falls significantly below that of the white population.



³ A minority household is one where the person named as owner or primarily responsible for the rent classifies his or her race as non-white.

Language spoken at home

About six percent of the population of Cumberland County speaks a language other than English at home. Half (47%) of these speak French (Table 4). No other language is prominent, although the county has more than 1,000 speakers of Spanish and German. The most common non-European language, with fewer than 400 users, is Mon or Khmer the language spoken by Cambodians.

Table 4. Non-English Languages Spoken at Home, Cumberland County 1990

Any Non-English Language	12,780	100.0%
French or French Creole	6,027	47.2%
Spanish or Spanish Creole	1,260	9.9%
German	1,060	8.3%
Italian	771	6.0%
Other Indo-European language	530	4.1%
Polish	443	3.5%
Mon-Khmer	387	3.0%
Greek	355	2.8%

Only 3% of the county's 1990 population were born outside the United States. Half of these had lived in the U. S. for 15 years or more at the time of enumeration. Consequently, most of those who speak foreign languages are also proficient in English. However, about 3,800 people do not speak English "very well." (Table 5)

Asians and older residents are most likely to report language barriers (Figure 10). More than 1,700 of these are linguistically isolated, meaning that not only do they not speak English very well, but no one in their household does either. Thus, while by Census count Asian populations are low (1,300), they are the most likely to be linguistically isolated (34%) (Table 5)

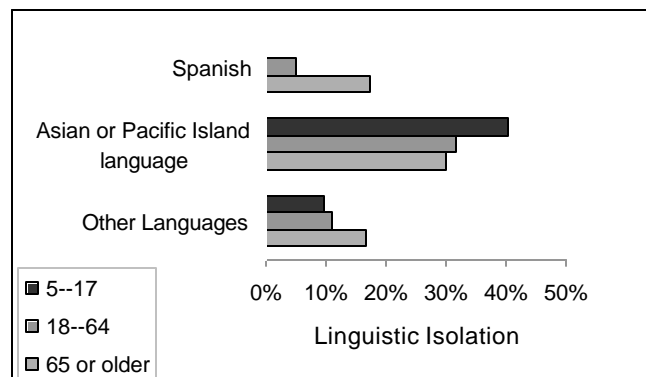


Table 5. English language proficiency and linguistic isolation, Cumberland County 1990

First language	Do not speak English very well	Linguistically Isolated
All languages	3811	1763
Spanish	308	57
Asian or Pacific Island language	770	435
Other Languages	2733	1271

Linguistic isolation affects more than 80% of older adults of retirement age - a group that was found from our previous experience to be very likely engaged in harvesting activity.

3.2.1 Summary of Demographic Characteristics for the Southeast Asian Community

The information provided above gives the following insights into the Southeast Asian community that are important for understanding the potential for exposures and for the design of survey and communication methods. These include:

- the population is relatively small (~4,000 individuals);
- the population is comprised of a variety of smaller groups that differ in their primary languages; Vietnamese is the largest identifiable group and “other Asians” is the next largest;
- the population is concentrated within a few square miles in the Portland area;
- the population tends to be poorer and less educated than the white population; and
- Asians are most likely to be linguistically isolated.

These observations have the following implications for the project. First, because of total population is relatively small, the actual numbers of people engaged in shellfishing activities may also be small even if there is a proportionally higher segment of the Southeast Asian population engaged in this activity. Because the population is made up of a variety of groups and because linguistic isolation may be an issue, there are challenges to obtaining information from the community at large using a single survey instrument or by contacting a single community leader or group. Because the population tends to be concentrated in a particular area, it is likely that the probability of shellfishing (and fishing) activity decreases with distance from this area. The area where the population is located is near areas of contamination (e.g., Back Cove) and therefore, it is important to determine whether these specific areas are used for shellfishing by members of the Southeast Asian community. Use of such areas could present a health risk to members of the population.

4.0 OBSERVATIONS OF SHELLFISHING AND FISHING ACTIVITY

We relied on observations to determine whether shellfishing is occurring in the areas identified as being of potential concern (Chapter 2). We sought to identify groups that collect and/or consume shellfish at higher rates than other Mainers. The survey of contaminants in mussels indicates that the following locations are of potential concern: Back Cove in Portland, Punchbowl at Jewell Island, Harraseeket River in Freeport, Wolfe's Neck Woods State Park in Freeport, Quahog Bay in Harpswell, The Basin in Phippsburg, and Falmouth. Middle Bay in the Brunswick area is relatively free of contaminants in mussel tissue. To determine whether these, or areas near these, are being used for shellfishing or fishing we gathered information from three sources:

available reports;

interviews with shellfish wardens and others familiar with shellfishing practices;
and,

direct observations by our personnel (or interns).

Our review of the available reports, our notes from the interviews and a list of people to contact for information about shellfishing in Casco Bay are given in Appendix A. Recreational fishing and/or shellfishing occurs in the following areas according to Shellfish Wardens, Marine Patrol officers, and local environmental groups:

Little River, Wolfe's Neck Woods State Park, Harraseeket River and Winslow Park in Freeport

Middle Bay in Brunswick

Strawberry Creek and Quahog Bay in Harpswell

The Basin, Hermit Island, Atkins Bay and Mill Dam in Phippsburg

New Meadows River and Back Cove in West Bath

Back Cove, the State Pier, the Fore River, East End Beach/Eastern Promenade and around the Casco Bay Bridge in Portland

Riverton Trolley Park on the Presumpscot River (freshwater) in Portland

Martin Point Bridge in Falmouth

Jewell Island, Cliff Island, Peaks Island, Chebeague Island, Little Diamond Island, Great Diamond Island and Cousins Island in Casco Bay.

These areas, which include some of the areas identified as being of potential concern, are shown in Figure 11.

To supplement the information from the shellfish wardens, marine patrol officers, and shellfish council members, we made observations at several locations in Casco Bay during the summer of 2001. The purposes of making such observations are:

To confirm observations of subsistence activity made by local authorities or other contacts;

To identify any sub-populations who might be more at risk from eating contaminated shellfish (e.g., ethnic groups, sensitive sub-populations such as children or senior citizens).

Locations were selected based on the following criteria:

- Number and concentration of contaminants in blue mussels exceeding action levels;
- Frequency of use for recreational and commercial shellfishing;
- Proximity to populated areas; and,
- Accessibility (e.g., ability to walk to shellfish beds rather than by boat, reachable by public transportation).

Observations were made on at least one occasion at most sampling locations where mussel concentrations exceeded action levels. Detailed observations of recreational shellfishing were not made in Falmouth because shellfish beds in the Falmouth area were closed during the time this project was conducted (May to September of 2001). Detailed observations were not made in Middle Bay because no action levels exceeded concentrations in blue mussels.

Observations of recreational shellfish harvesting were made at low tide during the summer of 2001 at the locations listed in the table below. Observations were conducted on weekends in most areas, because shellfish wardens and marine patrol officers have reported that there is more recreational activity at that time.

Table 6. Summary of Observation Locations

Location	Observer(s)	Timeframe
Freeport ^a	Nicole Pelletier	July 14, 27 and August 11, 2001
Wolfe's Neck Woods State Park	Patricia Bailey	July 29 and August 9, 25 & 27, 2001
Harpswell ^b	Nicole Pelletier	July 21 and July 28, 2001
Phippsburg and vicinity ^c	Nicole Pelletier & Jennifer Charles	July 2, 2001
Portland and Islands		
Eastern Promenade	Cheri Butler, Jennifer Charles & Emily Driscoll	June 29, 2001
State Pier	Cheri Butler, Jennifer Charles & Emily Driscoll	June 29, 2001
Back Cove	Cheri Butler	July 27, 2001
Jewell Island	Gerhard Saas	June through August, 2001

^a Nicole Pelletier made observations at Little River, Winslow Park, and Wolfe's Neck Woods State Park on weekends. Patricia Bailey, the Interpretive Specialist at Wolfe's Neck Woods State Park made observations of shellfishing activity from the park during weekdays.

^b Locations visited in Harpswell were: Strawberry Creek and Quahog Bay

^c Jon Hentz, Shellfish Warden for the Phippsburg area, gave Nicole Pelletier and Jennifer Charles a tour of the area he patrols. Locations visited in the Phippsburg area were The Basin, Hermit Island, Atkins Bay, and Mill Dam in Phippsburg and Back Cove in West Bath.

4.1 Little River in Freeport

We made a number of observations at the Little River in Freeport. This area is easily accessible, has convenient parking and is also accessible from Wolfe's Neck Woods State Park. This site is used most actively for recreational harvest of clams.

Patricia Bailey's observations of shellfishing activity around Wolfe's Neck Woods State Park revealed that shellfishing is popular during the week as well as on weekends. She made observations on different days of the week (Monday, Thursday, Saturday and Sunday) and observed people shellfishing all four times she made observations. There were people of all ages engaged in the activity (families with children and older adults). She observed people harvesting clams and mussels in the area.

Dan Brown, the Marine Warden in Freeport indicated that the Little River and Winslow Park are popular for recreational digging (and commercial digging in the Little River area) in Freeport. Visitors and tourists camping in the area make up a fraction of the recreational diggers. People from towns in Maine that live away from the coast also engage in shellfishing in Freeport. Mr. Brown reports that a fair amount of recreational harvesters make "repeat visits" to the Wolfe's Neck/Little River area. This is particularly the case for people from neighboring towns, as confirmed by Pat Bailey. She spoke with a couple from Naples, ME who said they come to Freeport often to dig clams. The couple said that they shellfish in Freeport because clams are relatively expensive where they live (Naples is almost 50 miles inland) and because it is a good source of physical activity.

4.2 Harraseeket River in Freeport

On the flats of the Harraseeket River in Freeport, Nicole Pelletier observed one digger within sight of the marina. This digger appeared to be a commercial digger, however he was not seen on subsequent observations. Although Winslow Park in Freeport was cited as another popular area for shellfishing, we did not observe anyone engaged in that activity this past summer (2001). However, the park ranger for the park does observe clam and mussel harvesting in the area, primarily by commercial diggers. The park ranger stated that he was not aware of any illegal harvesting in the area.

Dan Brown, the Marine Warden in Freeport mentioned that the Harraseeket River is a popular area, especially among commercial diggers. Part of the river is seasonally closed (from May 1 through November 30) because of the marina activity there. Shellfishing is prohibited in another area due to the presence of a sewage treatment plant, but three other areas in the Harraseeket River were open during the summer of 2001. Mr. Brown indicated that the area near Wolfe's Neck Woods State Park (coincident with the CBEP's mussel sampling location) is currently the most popular area for recreational shellfishing because people can dig up to 1 peck of clams without a town or state license. The area is also easily accessed from the park or from a parking area near the bridge that crosses over the Little River. He has also observed mussels being harvested from that area by recreational diggers.

4.3 Quahog Bay/Harpswell

Our observations of Harpswell indicate that the area is predominantly used by commercial diggers. Commercial diggers were observed at Strawberry Creek and dig marks and footprints were observed at Quahog Bay, but no recreational diggers were observed at either of the Harpswell sites. Although we did not see any shellfishing in

Quahog Bay (an area of potential concern) during our observation periods, dig marks indicate that shellfishing activity does occur there.

Available reports also show that shellfish harvesting in Harpswell is heavily commercial. Despite the large number of recreational licenses issued in Harpswell (480 in the year 2000), the Council member representing that area estimated that 90% of recreational diggers dig only occasionally, probably no more than 6 times per year. There is anecdotal evidence that some mussel harvesting takes place in Harpswell. The Shellfish Warden for Harpswell also confirmed that there is no record and no license needed for recreational mussel harvesting. Therefore, we are not able to determine the extent of mussel harvesting in Casco Bay from the available records. The Area Biologist mentioned, however, that mussels are relatively cheap to buy, so it would seem less likely that people would be harvesting them for subsistence purposes. Another member of the Shellfish Council mentioned that the mussels gathered in areas where they are exposed to the air are not recommended for consumption, because they are tough and may have more pearls in them. Mussels that are continuously submerged are more desirable for consumption. Attitudes about mussel harvesting may be different within different cultural groups, however.

Mr. Josh Potvin, Deputy Sheriff for Cumberland County, mentioned that Strawberry Creek is one of the most popular areas for harvesting soft shell clams in Harpswell. He has noticed a greater ethnic diversity of recreational shellfishers in the summer compared to other times of the year and he has observed people of lower income engaged in this activity. We attempted to confirm these observations in a follow-up interview, but Mr. Potvin could not be reached.

Sgt. David Mercier, a member of the Marine Patrol, supervises 7 patrol officers in the area from Portland to Bath. This area is patrolled daily, year-round. Sgt. Mercier has observed shellfishing activity in Harpswell on his way to work from Route 123 and Route 24. He said that people generally harvest softshell clams, blue mussels, some quahogs (but they are not numerous) and occasionally European oysters introduced to the area by aquaculture. He reported that shellfishing is more common on warm days in the late spring and summer and on the weekends.

4.4 The Basin/Phippsburg/West Bath

The Phippsburg/West Bath area also proved to be an area with predominantly commercial harvesting. One recreational digger was observed, however he had worked as a commercial digger until recently. Jon Hentz, Shellfish Warden for Phippsburg and four other surrounding municipalities, specifically mentioned Hermit Island in Phippsburg as a popular area for recreational shellfishing by visitors and tourists because people can buy short-term licenses to harvest there.

Mr. Hentz said that Phippsburg has many areas that are popular and easy to access for recreational and commercial harvesting. He said that areas of the Basin are heavily harvested (i.e. overharvested) during the autumn months. During the summer there is minimal shellfishing activity and the area is used as a place for parties. No recreational

activity was observed during visits to the Basin this summer, but such activity may occur there.

Mr. Hentz mentioned that there has been an increase of blue mussel harvesting in his jurisdiction, which he has added to the town reports. He added that this is a concern because people are often harvesting mussels in areas closed to shellfishing due to bacterial contamination. He also noted that people who harvest in closed areas take more than clams and the most common violation he sees is that people do not know about the closures. Jon has seen mostly white males harvesting shellfish, however, he has heard of Asian people harvesting seaweed at Reid State Park in Georgetown. He also noted that a great deal of recreational licenses sold in Phippsburg go unused.

Marine Patrol Officer Michael Fitzpatrick, who patrols Phippsburg, Bath, West Bath and the Kennebec River to Augusta, also reported making daily observations of shellfishing and fishing. He has observed shellfishing activity at Hermit Island and several other locations in Phippsburg, Atkins Bay and Wyman Bay on the Kennebec River, and West Bath. He estimates that he has seen 25 people harvesting clams, quahogs, mussels or oysters in the past year, especially during the warmer months (April through October). He said that most of the diggers he has observed are local, commercial diggers.

4.5 Jewell Island

Our observations of shellfishing activity at Jewell Island indicate that shellfish harvesting is occurring there. Gerhard Saas, the caretaker of Jewell Island for the Maine Island Trail Association, reports that mussels are more commonly harvested than clams on the island. Also, he observed the most shellfishing in Cocktail Cove on the west side of the island.

Mr. Saas observes activities of the visitors to Jewell Island, Little Chebeague and Crow Island. These islands are accessible only by private boat (the Casco Bay Lines ferry does not provide service to these islands). He made observations for us 7 days a week during June, July and August of 2001. An article was published in the June 18, 2001 issue of the Portland Press Herald about Gerhard's activities and responsibilities as Caretaker of Jewell Island.

Mr. Saas observed quite a bit of shellfishing for mussels on Jewell Island and Little Chebeague. People also harvested clams and he saw evidence of raking on both islands. He observed about 50 people harvesting mussels at these islands this summer. To his knowledge, these people are all harvesting for recreational purposes. Mr. Saas said that people of all ages use the islands, however, he has not noticed much ethnic diversity among the visitors to the islands.

In general, the people harvesting mussels spend the day or stay overnight. He has seen them eat the mussels. He has only seen one person, who lives on Cliff Island, dig clams with any regularity (once every couple of months.) This person harvests quite a bit of clams, but has told Mr. Saas that he is not a commercial harvester. The person said that he keeps all the clams he harvests and will freeze what he does not eat right away. He will also come to dig in the spring, fall and winter months (not just the summer).

4.6 Back Cove and Other Portland Locations

Shellfishing was not observed by us and has not been recently reported by others in Back Cove.

Because Portland does not have a Shellfish Warden, we asked local groups about the extent of shellfishing activity in Portland. There are no open shellfish areas in the City of Portland, including islands in Portland boundaries. All shellfish harvesting in Portland is prohibited by the DMR. Figure 12 shows the location of mudflats along the coast of Portland. We are unsure whether these flats are suitable shellfish habitat, however, this figure illustrates the extent of areas where people who are not aware of shellfish bed closures may potentially engage in shellfishing activity.

A Portland Parks and Recreation Department employee reports that there are “clammers” on the Eastern Promenade. However, when they bring their catch into the landing they are required to go through an extensive purification process. The Marine Patrol monitors those people who bring their catch to the landings, ensuring that they follow the purification procedures. The DMR are not constantly monitoring the area, but are apt to show up at random times. We assume that the individuals that she is referring to work for companies that have licenses to collect shellfish in closed areas because they deperate them before selling them.

Our contact at Parks and Recreation also noted mussel harvesting and lobsterman fishing and setting traps off of the Eastern Promenade and in the Back Cove. We confirmed the lobstering activity while making observations in Back Cove and the Eastern Promenade on July 27, 2001. We also visited the Eastern Promenade area on June 29, 2001 and noticed a number of people fishing off of a nearby railroad trestle, despite a “No Trespassing” sign on the trestle. The woman at Parks and Recreation explained that the trestle is owned by the railroad company and they put up the sign up to protect themselves by law. They do not like people fishing there, but they do not actively police the area.

The residential neighborhood above the Eastern Promenade is Munjoy Hill. We contacted Lt. Ross from the Portland Police Department who deals with community affairs in this area. Lt. Ross said that they [the Portland Police] are occasionally called on for backup in situations where there may be a problem with harvesters. However, in the 16 years that he has been working in the area, this situation has only arisen “a handful of times.”

Peter Milholland at the Friends of Casco Bay said that productive shellfish beds exist on Cliff Island and Peaks Island. He reports that, despite the fact that they are closed, harvesting occurs in the area between Little Diamond Island and Great Diamond Island.

4.7 Yarmouth

We did not make direct observations in Yarmouth. According to Warden Guy Watson, there is no mussel harvesting in Yarmouth and mussel harvesting is actively discouraged. The Warden has identified people of lower income engaged in shellfishing. Mr. Watson reported that (during the summer of 2001), he has seen one man, presumably from Portland and of low socioeconomic status, at Sandy Point daily. In a later interview with the Warden, we learned that he had established that the person was not eating his harvest, but is selling it. There are also some Yarmouth residents that are harvesting daily, however the Warden thinks that those recreational diggers that dig daily are either giving clams away or selling them. He does not know of any family or single person who eats clams on a regular basis. The most popular areas for recreational harvesting in Yarmouth are Sandy Point and Sea Meadows on Cousins Island and the Old Town Landing.

We contacted a recreational digger who harvests clams at least twice a month in Yarmouth on Cousins Island. He harvests clams in the areas cited by Guy Watson as popular for recreational harvesters (Sea Meadows, Sandy Point and the Old Town Landing). He harvests a peck every time he goes out and his family (him, his wife, grown children and grandchildren) eats them within a few days after they are harvested. They steam the clams or fry some of the larger ones. Most of them eat 20 to 30 clams, but the digger reported eating 4 bowlfuls (or approximately 60 to 70) clams. He harvests the clams both for fun and because his family likes the taste of clams so much. He is aware of closures and says the people he sees harvesting shellfish are primarily white males. He is aware of laws related to shellfish harvesting (peck limits, size limits and flat closures).

4.8 Summary of Observations

Our observations this summer confirmed information obtained from the Shellfish Wardens in Freeport, Harpswell and Phippsburg about the level of commercial vs. recreational shellfish harvesting. Recreational activity was infrequent or not observed at most of the areas of potential concern during our observation periods, with the exception of the Little River area near Wolfe's Neck Woods State Park in Freeport and on Jewell Island. We were unable to gather any quantitative information about shellfish consumption in these areas.

We did not observe shellfishing activity occurring in areas such as Back Cove, The Basin and Quahog Bay where the number and concentration of contaminants in mussels were high. However, Shellfish Wardens have reported commercial shellfishing in the Harraseeket River and The Basin where concentrations of one or more contaminants in blue mussels exceed action levels.

Observations at these locations of concern did not clearly indicate the presence of groups that collect and/or consume shellfish at higher rates than other Mainers. Not surprisingly, due to the small size and location of the Southeast Asian population in Maine, we did not detect participation by the Southeast Asian population in shellfishing activities at these locations. We will discuss our further research into the harvesting activity of the Southeast Asians living in the Portland area in Chapter 5.

5.0 SURVEY OF SOUTHEAST ASIAN COMMUNITY

This chapter of the report provides results of the preliminary survey of the Southeast Asian community of Portland with respect to consumption of locally-caught shellfish or fish. We described our proposed survey methods in the Quality Assurance Project Plan (Menzie-Cura, 2001). The planned approach was modified somewhat while the work was underway to deal with various problems that arose with getting responses. By far, reaching the target population and dealing with language barrier issues were the most challenging aspects of the survey. The methods that were applied, the problems encountered, and the approaches used to resolve these problems are described in Appendix B. In this chapter, we first provide an overview of the survey methods and then give the results from those surveys.

5.1 Overview of Survey Methods

Our preliminary investigation into harvesting and consumption practices by Southeast Asians in Portland began by establishing a rapport with community leaders. Our contacts confirmed the Census information and identified the two largest sub-groups of Southeast Asians to be Vietnamese and Cambodian. We then developed, translated and distributed a fish and shellfish consumption mail survey to these two communities and also to the Filipino community. This mail survey was followed by telephone interviews with members of the community.

The surveys focused on obtaining the following types of information:

- harvesting patterns of those sub-groups (e.g., locations, frequency, times of year, species taken); and,
- consumption patterns of those sub-groups (e.g., food preparation, amounts per meal, numbers of meals on a weekly, seasonal, or annual basis).

We used two survey approaches in this study: a mail survey and telephone survey.

5.1.1 Development and distribution of mail survey

The survey was designed based on experience gained from other seafood consumption surveys (e.g., mail, telephone and creel). A copy of the mail survey we developed for this project is in Appendix B. Two translations of the survey, one in Vietnamese and one in Khmer, are also included in Appendix B. The “sampling unit” for this survey is an individual within the household to which we mail a survey. We do not specify who within the family should fill it out and we do not include any survey questions identifying the age or gender of the survey respondent. Therefore, the results represent a sampling of harvesting patterns and consumption rate among all members of the Southeast Asian community. To assist the respondents in identifying the types of seafood that they catch and eat, we used pictures of fish and shellfish species throughout the survey. We used pictures because people may not be familiar with the common names of seafood, due to a language barrier, but they probably know what it looks like.

With the help of Mr. Lan Tran, we mailed 119 copies of the Vietnamese translation of the survey to members of the Vietnamese community in the Portland area. With the help of Mr. Pirun Sen, we mailed 125 surveys, with the questions in Khmer on one page and in English on the facing page, to members of the Cambodian community in the Portland area. We also mailed 11 copies of the survey in English to members of Fillipino community. In each envelope mailed, we included a letter from our community contact (Mr. Tran, Mr. Sen), a copy of the survey translated into the person's own language and a self-addressed stamped envelope to return the completed survey to us. About 4 weeks after mailing the surveys, we mailed a follow-up post card. The response rate for the mail survey, with post-card follow-up, was 6% (16 surveys returned of the 255 mailed).

5.1.2 Telephone Interviews

We obtained lists of names and telephone numbers from community leaders in the Southeast Asian community. Where lists could not be procured (e.g. Vietnamese community), we developed a data base from the telephone directory using commonly identifiable Vietnamese surnames. Together these lists identified 100 contacts. During the second half of 2001 and early 2002 we made calls to the 100 people on the lists and reached 54 households. Of these 54 contacts, 36 resulted in completed interviews. Thus the survey response rate was 36%. The reasons for incomplete interviews include refusals, lack of a person who could speak on behalf of the household, or language barriers. While we cannot verify this, we suspect that respondents interviewed (obtained from the list) may under-represent the poor and recent immigrants. A comparison of response from lists derived from community contacts with those developed from telephone directories seems to bear this out. We found that Vietnamese contacts from our telephone directory lists were more likely than other contacts (whose names we received from community leaders) to report some English language limitation. Individuals whose names are provided by community leaders may be highly visible in the group and therefore may not represent the entire community and certainly would not be the most recent and less assimilated immigrants.

5.1.3 Data analysis methods

When each mail survey was received, a unique letter and number identifier was written on the top of the survey along with the date it was received. The responses were then coded in an Excel spreadsheet and summarized (Appendix C). Telephone survey results were also tabulated (Appendix C) and graphed in Excel. The sample size is small and likely does not capture the range of behaviors present in the community. This must be borne in mind when interpreting results. Acknowledging the limitations of a small sample size, we proceeded to develop preliminary estimates of consumption rates. Again, these should be viewed as a sampling of consumption rates among members of the Southeast Asian community and are unlikely to reflect the entire range of consumption rates.

We used two different approaches to determine the amounts of locally-caught seafood eaten by the respondents (in grams). One approach was to convert the amounts of seafood survey respondents reported consuming (in cups or number of shellfish) to grams. The other was to estimate amounts consumed, assuming a standard meal size, from the

frequency of consumption reported by survey respondents. These approaches are described further in Appendix B.

5.2 Survey Results

The survey response consists of 16 returned mail survey forms (out of 225 surveys mailed) and 36 completed telephone surveys (out of 52 Southeast Asian families contacted). This section summarizes the results of the mail and telephone surveys in terms of the following questions:

What specific locations are being used by survey respondents engaged in shellfishing and fishing?

What species are they harvesting?

How frequently are people engaging in this activity?

What times of year are the areas being used?

How much seafood is consumed per meal?

How many meals of marine species are consumed per week? per year?

Does consumption vary seasonally?

How is the seafood prepared?

What parts of the organism are eaten?

Thirty-six interviews with Southeast Asian families were completed via telephone. Seventy percent (25) of the respondents reported consuming some kind of fish or shellfish that they caught themselves. Most of these ate only fish and not shellfish (Figure 13). About one-fifth of the people reported eating shellfish that they harvested from Casco Bay. Fifty-six percent of the mail survey respondents reported consuming some kind of fish or shellfish that they (or a family member) caught themselves. Most of the mail respondents ate fish and shellfish and most of these people reported eating shellfish that they harvested in Casco Bay.

A large percentage of harvesters take fish only from piers or other shore locations (see Figure 11). Question number 5 of the mail survey asked respondents to indicate where they harvested each seafood item (see Appendix C). South Portland beaches figured prominently for these activities. Shellfishing activity was reported in South Portland, Martin's Point, the Route 1 bridge between Portland and Falmouth and at three locations outside of Casco Bay (Old Orchard Beach, Saco and Augusta). Several respondents who reported not fishing in the ocean, do fish in a freshwater lake. Sebago Lake was the most commonly identified location for fresh water fishing. Augusta was the only fresh water location where shellfishing was reported.

Some families fish using their own boat or fish with friends who go out in boats. Having use of or owning a boat seems to be more common than would have been expected in an immigrant population.

Most telephone survey respondents said they went fishing because they enjoy the activity, or gave other recreational reasons such as enjoying the company of other people, or relaxing (Figure 14). Half said that fishing was an activity they pursued with family members, and another quarter said they went with friends or neighbors. Only 22% reported typically fishing alone.

About a third, however, said they needed either the food or the income supplement that fishing would bring, and more than a quarter mentioned that fishing was motivated by their desire to eat seafood. Only one in six explicitly said that they continued the activity because they had practiced it before coming to Maine. Similarly, most mail survey respondents said they harvested seafood for food, and secondarily for recreation. Only one-quarter of the mail survey respondents said they were aware of fish advisories. Most of the other respondents did not answer the question or chose the “Do n’t Know” response.

Fish are by far the type of seafood most frequently consumed, with clams a distant second (Figure 15). About 20% of our respondents reported eating clams. Ten to twelve percent mentioned mussels, crabs, and lobsters, and one or two people mentioned more exotic species such as snails and sea urchins.

Mackerel and striped bass are the most commonly mentioned fish species caught by respondents. About a third of the fishermen (and women) take mackerel, and a quarter of them take bass.

The results of the mail survey indicate that most people are catching and eating seafood during the summer months. Two respondents reported eating seafood in months that they did not fish, thus they may be freezing their catch and saving it for consumption later.

Most people reported eating different types of seafood once a year or once a month. However, fifty percent of mail survey respondents reported consuming fish once a week. While some people reported never consuming some seafood items, no respondents reported eating any seafood more than three times per week.

We used the available information to estimate consumption rates, recognizing the uncertainties in the estimates as described in section 5.3. Our estimates are used to give preliminary insights on whether the Southeast Asian population consumes more locally-caught seafood than an “average” person for the purpose of calculating health risks. In other words, we examined the data to see if there was evidence of subsistence fishing, especially for shellfish. In the table below, we compare total seafood consumption rates for the Southeast Asian population derived from our survey results to consumption rates for other sub-populations that are published in USEPA’s Exposure Factors Handbook (USEPA, 1997).

Table 7. Comparison of Consumption Rates for Total Seafood (Fish and Shellfish)

	Mean (g/day)	95 th %ile (g/day)	Source
Southeast Asian survey population in Portland, Maine (n=5)	28.8	-	Derived based on both consumption amounts and frequency reported by survey respondents (See Appendix B)
Southeast Asian survey population in Portland, Maine (n=12)	0.35 – 55 ^a	0.89 – 140 ^b	Derived based on consumption frequency reported by survey respondents (see Appendix B)
NFCS data for consumers living in households who fish	130 ^c	-	USEPA 1997, p. 10-7
Recreational Marine Anglers	6.2 ^d	20.1	USEPA 1997, Table 10-52
Native American Subsistence Fishers	70	170	USEPA 1997, p. 10-26

^a Derived based on a mean serving size for “All Fish” (Finfish and Shellfish) for consumers only, uncooked fish weight of 129 grams (approximately 4.5 ounces). The range of consumption rates reflects the range of consumption frequencies reported by survey respondents (i.e. once per year, once per month, once per week, three times per week).

^b Derived based on the 95th percentile serving size for “All Fish” (Finfish and Shellfish) for consumers only (uncooked fish weight) of 326 grams (approximately 11.5 ounces). The range of consumption rates reflects the range of consumption frequencies reported by survey respondents (i.e. once per year, once per month, once per week, three times per week).

^c This intake rate represents respondents to the NFCS survey who answered “Yes” to the question “Does anyone in your household fish?” and reported consuming fish in the week of the survey. The mean intake rate (2.2 g/kg-day) was converted to grams per day by multiplying by the estimated average weight of survey participants of 59 kg. This intake rate reflects the weight of fish taken into the household. Multiplying this intake by an edible fraction of 0.5 results in an intake of 65 grams per day that reflects the amount of fish consumed. The edible fraction may be species-specific, but 0.5 is an average value cited in the Exposure Factors Handbook.

^d This value represents the average daily intake of marine finfish in the North Atlantic (defined as ME, NH, MA, RI & CT) derived from the National Marine Fisheries Statistics Survey.

In addition to a “total seafood” consumption rate, we were able to derive preliminary consumption rates for finfish and shellfish separately for the Southeast Asian population (but only based on results from respondents who reported both the amount and frequency of consumption). The preliminary mean consumption rate for finfish is 16.7 grams per day and the preliminary mean consumption rate for shellfish (using clams as a surrogate for shellfish) is 14.7 grams per day. However, these rates are based on very small sample sizes: four and two data points, respectively.

The ranges given in the table above suggest that seafood consumption rates of Southeast Asians embrace a broad range. Mean values range between <1g/day and 55 g/day while the 95th percentile values range up to 140 g/day. In comparison, the mean reported for Native American subsistence fishing people is 70 g/day and the upper percentile value is 170 g/day and the mean consumption rate for the average Main angler is 6.2 g/day with an upper 95th percentile of 20.1 g/day. Our small sample size does indicate that the Southeast Asian population does fish and shellfish and that the amount of shellfish consumed is variable. Despite the limitations of the small data set, the results indicate that the consumption rates of the Southeast Asian population overlaps with the general coastal population and might include some families that rely on locally-caught fish and shellfish as an important part of their diet based on 95th percentile values of up to 140 g/day. Again, we caution against using these consumption estimates to quantify exposure and risk for the population as a whole. However, they give preliminary insight into the possibly broad range in consumption rates for this population. More comprehensive studies are likely to broaden the estimated range and provide better definition at the tails of the statistical distributions of fish and shellfish consumption rates. The uncertainties in this analysis will be discussed further in the following section.

Most of the telephone interview respondents deep-fried (31%) or grilled (22%) their catch, but a few steamed them or made soups. Two respondents mentioned stir-frying, and two others ate smoked fish. None of the people interviewed reported that they ate any of the seafood raw. The most common methods of seafood preparation among mail survey respondents were steaming, stir-frying, and pan or deep frying. Most people reported eating the fish fillet, but 44% also ate the head or cheek and eggs. One mail survey respondent reported eating uncooked oysters and sea urchins.

5.3 Uncertainties in Survey Results

Much of the uncertainty in the survey results stems from the small sample size. This was a result of two factors: the small size of the identifiable Southeast Asian population in Portland, Maine and the low response rate from this community. Other uncertainties arose from the manner in which the data were analyzed. Due to the limited number of responses to the mail survey, we estimated fish consumption from meal frequency data by assuming a range in the mass of shellfish or fish per meal. Thus, there is some uncertainty associated with this estimate. Only five respondents provided direct estimates of amounts eaten.

We were able to identify the areas where shellfishing was very limited as well as where it is popular. However, we have limited data on the frequency of recreational shellfishing at

a specific location and whether people return to the same site. The frequency of shellfishing activity is related to such factors as accessibility and attractiveness of the area, availability of other shellfishing areas, and weather conditions.

The poor response rate to the mail survey deserves more discussion that may help when planning other, similar studies. We found it very hard to contact people during the summer when school is out and families may be away from home. However, summer is the best time of year to ask people about shellfishing activity because they are most likely to be engaged in such activity in the summer while it is warm. We believe that the recall bias for such activity is likely to be lower in the summer. Lack of human contact in administering the mail survey decreased motivation of people to respond. We would expect greater success if we were able to distribute the survey at community events (in addition to distribution by mail) as we originally intended. However, such events did not occur during the summer months due to school vacation. Events occurring earlier in the year were not appropriate forums for distributing the survey.

Second, at least one respondent commented that the survey was too long. The length of the survey instrument can be especially frustrating for someone who does not read and write very well, even in their native language. According to a community contact person at the Portland Schools' Office of Multilingual and Multicultural Programs, some of the members of immigrant families are illiterate. Therefore, even though we had the survey translated into a person's native language, he or she still may not have been able to read it. Although we tried to minimize survey length, it appears that it was still too long for this survey population.

Third, the response rate could be improved by offering a monetary incentive for returning the survey and completing more rigorous follow-up activities (e.g., by phone or personal interview). We did not ask for the names and telephone numbers of the people who received the survey in order to make respondents feel more comfortable and hopefully increase the response rate. Thus, we could not contact people who responded to the survey unless they indicated that they were interested in receiving the survey results. Because we do not have names and telephone numbers of people who were sent the survey, we cannot estimate non-response bias. Therefore, if people didn't respond, we don't know if it's because they aren't engaged in shellfishing or fishing activity or are engaged in the activity, but don't want to say what they are doing.

Due to difficulty in contacting members of the Southeast Asian community, we were unable to distribute both a pilot test survey and a revised survey based on input from community members. Therefore, the survey described in this report serves a dual purpose. On one hand, it was used to test whether questions were understood, question format was acceptable, and the survey length was appropriate. On the other hand, it was used to collect preliminary information on harvesting activity and consumption information for three subgroups of the Southeast Asian population.

Respondents were asked about fish and shellfish that people catch themselves. This study does not address their consumption of shellfish and fish bought at local fish markets or grocery stores, even though many respondents wanted to assure the interviewer that they purchase most of their seafood. We know that fish is a preferred food item for members

of the Southeast Asian community, however we did not collect information about how much of a person's total fish intake is comprised of fish he or she catches. The proportion of a person's diet that is obtained from noncommercial vs. commercial sources would be a good subject for a follow-up study.

This study did not consider commercial shellfish harvesters as a potential "sub-population at risk." However, it is possible that commercial harvesters may actually eat more shellfish and/or fish than the average person.

5.4 Data Quality Review

In order to ensure consistency in observational data, we developed an observation form that was used by all observers at all locations during the summer of 2001. We also used interview protocols for interviews with local authorities and members of Southeast Asian community. The observation form and interview protocols are in Appendix A.

Precision

We were able to interview Falmouth's Shellfish Warden in May and again in September. The results from these two interviews are shown in Appendix A and did not result in different conclusions about shellfishing activity in Falmouth.

We also conducted follow-up interviews with people from the Southeast Asian community who responded that they participate in fishing or shellfishing activity in order to judge precision in recall. We had difficulty reaching people for these follow-up interviews. Many respondents do not have phones in their names because several families might live in one household. Two call backs proved a high level of consistent answers. One finding from these interviews was that, while respondents on the mail survey underutilized the map, location information was more forthcoming if asked directly in phone contact.

The telephone interviewer found that many individuals insist that, though they eat seafood, they consume seafood only from commercial sources. On prodding, someone suggested that if a friend gave him seafood he would eat it, but generally he bought seafood from markets.

It should be noted that, while individuals who responded to the mail survey might respond that they ate more conventional types of fish (lobster, shrimp, crab) and most often buy it, they also responded to question 11, which asked about parts of finfish consumed. There is some level of inconsistency in this response that might reflect a level of defensiveness in an effort to conform to a "correct" response.

Accuracy

We confirmed shellfishing observations made by local authorities at several locations. Thus, our results are consistent and we believe the results provided in the report can be relied upon as accurate.

The results of the survey are considered reliable but we may have missed some members of the population whose behavior differs from those responding to either the mail survey or the telephone interviews. In particular, poorer people and those with more limited communication skills may have been less likely to respond to the survey. These individuals may be more likely to rely on locally-caught shellfish and fish. We have no direct way to assess this potential bias. Observations of shellfishing patterns did not reveal a large segment of the minority population engaging in these particular activities. However, a large percentage of survey respondents (70% for telephone survey and 56% for mail survey) reported consuming some kind of fish or shellfish that they caught themselves. Therefore, our survey results is likely to have captured the seafood consumption rate for members of the community who are more motivated and/or more frequently engaged in these activities.

Completeness

We were unable to conduct follow-up telephone calls to complete unanswered sections of the mail survey. The respondent had the option to provide contact information or to remain anonymous. Therefore, we could not follow up with many of the survey respondents. We stated that survey results would be kept confidential, and hoped that this would encourage people to respond. However, the approach taken limits our ability to follow-up.

We asked observers how frequently they make observations in a particular area. Most of the enforcement officers (Shellfish Wardens and Marine Patrol) patrol their assigned territory 40 hours/week. Nicole Pelletier made observations for approximately two hours at low tide on weekends when recreational shellfishing activity is expected to be highest. Pat Bailey made observations at low tide from Wolfe's Neck Woods State Park on different days of the week (Monday, Thursday, Saturday and Sunday). Gerhard Saas lived on Jewell Island for three months this summer and patrolled Jewell Island, Little Chebeague and Crow Island. Therefore, his schedule for observations varied somewhat.

6.0 CONCLUSIONS AND RECOMMENDATIONS

Our research and analysis has revealed the following:

Shellfishing occurs throughout Casco Bay. The areas identified by the Shellfish Council and Marine Patrol as "most popular" for recreational shellfishing were: The Harraseeket River and Wolfe's Neck Woods State Park in Freeport; The Basin and Hermit Island in Phippsburg; Strawberry Creek in Harpswell; Sandy Point and Sea Meadows on Cousins Island and the Old Town Landing in Yarmouth. Shellfishing in Back Cove and other more highly polluted areas appears limited. At most, this has been observed a "handful of times."

Shellfishing does take place in areas where elevated levels of contaminants have been observed in mussels. Individuals engaging in shellfishing activity in these areas appear to be mostly white males and sometimes families. Southeast Asians and other minority groups do not comprise an obvious higher proportion of people engaged in this activity. Currently, the Southeast Asian and other minority groups comprise only a small fraction of the population in Cumberland County. However, the size of these populations may be expected to increase substantially in the future due to State refugee resettlement efforts.

As is the case for the general shellfishing population, shellfishing and fishing activity by the Southeast Asian community is not localized, but spread out over greater Portland. Use of boats for these activities by Southeast Asians is not widespread, but more common than anticipated.

Anecdotal evidence suggests that members of the general population may be shellfishing anywhere from once a week to once a month. They primarily harvest clams and sometimes harvest mussels. Our telephone interviews reveal that members of the Southeast Asian community who are engaged in shellfishing or fishing activity may do so up to three times a week. For both populations, recreational shellfishing is more common in the warmer months of the year.

Potentially exposed individuals in the general population include local residents who harvest shellfish year-round for fun or because they like the taste of seafood. It is not easy to identify and contact these people, however, because there does not appear to be any unifying factor that allows us to reach this subpopulation. Therefore, it would take a concentrated effort to identify harvesting and consumption patterns in one community.

The surveys of members of the Southeast Asian community had a low response rate (16 returned mail surveys and 35 completed phone interviews). Thus the results from this survey should be viewed as providing preliminary insights. Acknowledging these limitations, our insights are:

The frequency of local seafood harvesting activity by the Portland Southeast Asian community is high (56 – 70%). Most of the locally-caught seafood eaten is comprised of fish, primarily mackerel and striped bass. Clams, mussels, other mollusks and crabs are also eaten.

Our estimate of the amount of locally-caught seafood eaten by the Southeast Asian population reveals that consumption by this population is likely to encompass a broad range, overlapping with those of the general population in Maine, but including individuals who rely on locally-caught fish and shellfish as an important source of food. More comprehensive surveys are likely to broaden the range in consumption rates and provide more definition for the statistical tails of consumption rates for the Southeast Asian population.

We offer the following recommendations:

The information we collected about fish consumption is limited to the Southeast Asian population in the Portland area. If consumption information for other recreational harvesters in Casco Bay is needed, we would suggest conducting a creel-like survey at one of the locations identified as popular shellfishing areas (e.g., Little River/Wolfe's Neck Woods State Park).

In this study, we determined that there are members of the Southeast Asian community in Portland who eat locally-caught freshwater fish and shellfish. If local freshwater environments are contaminated, this might be a source of exposure that deserves further study.

The Southeast Asian community in Portland is currently relatively small and diffuse. However, such communities can serve as anchors that promote further settlement. Thus, it is possible that this community will continue to grow. Because a high fraction of individuals who responded to our survey do fish and shellfish, it is possible that increased activity around Portland would be observed in the future.

Our study lays the groundwork for facilitating future communication efforts with the Southeast Asian community. Many of the contacts we have made in the community are related to central institutions, such as the public schools and Buddhist prayer meetings.

The results of this study can be contrasted with the study of Charles and Menzie (1998) carried out in Boston. There were three primary differences. The first is that the Southeast Asian population comprised a smaller fraction of the total population in Cumberland County (1.4%) as compared to Boston (5%). Second, the location of ethnic families in Portland is more dispersed. Their fishing and shellfishing patterns are also more variable in terms of location and frequency. Finally, there is greater use of boats in Maine so fishing occurs in deeper water where pollution is more diluted. Finfish is as accessible, or even more accessible, than shellfish for use as a supplemental food source.

Anchoring immigrant communities that reside in dense ethnic neighborhoods typically will retain original patterns of behavior in seeking resources to meet their needs in familiar ways. Familiar foods and forms of recreation are common ways to maintain group identity and ensure feelings of well being in an unfamiliar context. Subsistence shellfishing meets both of these needs for Southeast Asian coastal immigrant communities. In Boston communities, this activity is desirable due to their accessibility to shellfish flats and their need to supplement an otherwise limited income.

The extent to which this activity is practiced depends on the context, but it holds powerful meaning for the group (i.e. to maintain a collective identity by engaging in familiar and commonly appreciated activities). Because these behaviors find less frequent expression and/or there are fewer of them, the attachment to any given behavior might be stronger. The more dense and populous the community, the more developed and effective internal communication pathways evolve over time. These existing channels are the best means to strengthen or extinguish cultural behaviors. Southeast Asians in metro-Boston, including Lynn and Revere, will hold more tenaciously to shellfishing as an expression of culture because they live in larger and more close-knit neighborhoods and use more evolved communication channels to share common behavior patterns than those in Portland.

History of immigration for these groups shows that it occurs in waves usually in direct response to American legislative action or INS's administrative policy, which combines with social/political changes in the countries of origin to produce an influx of immigrants. Because an increase in anchoring communities is likely to occur over time, plans could be developed regarding future information gathering and monitoring efforts for the Southeast Asian community in Portland. These efforts may indicate a need for intervention.

7.0 REFERENCES

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