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APIA’S ALEUT TRADITIONAL FOODS PROGRAM MISSION STATEMENT:
Protecting and encouraging the use of traditional foods and better understanding about environmental pressures on subsistence species and human health.

This publication was made possible by grant number ES011075-02 from the National Institute of Environmental Health Sciences.
INTRODUCTION

The Aleut Community of St. Paul Island-Tribal Government partnered with the Aleutian Pribilof Islands Association in 2001 on a four year dietary study funded by the National Institute for Environmental Health Sciences (NIEHS). This project is entitled **Dietary Benefits and Risks in Alaskan Villages**. The purpose of this project is to develop a process that rural communities can use to evaluate the benefits and risks of their diet. The ultimate goal of this project is to help people make healthy dietary choices. Funded as a case-study, the intent is to apply the process used on St. Paul Island to other communities in rural Alaska.

This study was motivated by the question people are asking in the Aleutian and Pribilof Region as well as throughout rural Alaska: “Is our traditional food safe to eat?” To begin answering this question, it is important to evaluate the benefits and risks of the foods we are eating both from the store and from the land and sea.

The St. Paul Tribal Government was a partner in the development and implementation of this project. Community participation in all aspects of the project was essential to the success of the research. On St. Paul Island, a Village Advisory Group (VAG) was formed to address questions and help lead the research.

The VAG decided to look closely at the benefits and risks of consuming subsistence halibut. This decision was based on the high amount of halibut eaten locally and the importance of halibut at social gatherings. The attention that the media has placed on the contaminant, methylmercury, being found in fish affected the decision as well.

Halibut is important to the local diet and economy on St. Paul Island. It is a nutritionally important food for residents. Results from the 2003 dietary survey on St. Paul Island showed that halibut is consumed by more people in St. Paul than any other traditional food.1

Halibut is also important to the local economy. Since the commercial halibut fishery began in the early 1980’s, Pribilofians have had greater access to halibut. Commercial fishermen often share halibut with others on the island as subsistence fishing for halibut is costly. Many locals depend on the fishery for jobs. Because halibut is such a locally important food, St. Paul Island residents wanted to see if halibut could potentially be a pathway for contaminants entering humans.

There are many nutritional, social, cultural, economical, and spiritual benefits to consuming traditional foods. The findings from this study show that the risks of contaminant exposure from eating halibut are low. This report helps identify some of the known benefits and risks of consuming halibut.
BACKGROUND

WHY WAS THIS STUDY STARTED?

The St. Paul Island Village Advisory Group (VAG) decided to focus on halibut in this study. Although the VAG was interested in looking at other foods as well, the budget for sampling and analysis was limited. St. Paul Island residents are interested in learning more about contaminants and the potential sources and pathways of different contaminants entering the community. Food is one potential pathway for contaminants to reach the human body.

In the past, St. Paul Island residents participated in studies testing for contaminants in human blood. The findings from a 1999 study conducted by the State of Alaska, Department of Health, showed the presence of several persistent organic contaminants in peoples’ blood. However, the levels were not high enough in any person to present any known adverse health effects.2

St. Paul Island is currently enrolled in the Maternal and Infant Monitoring Program. This voluntary program, which is coordinated by the Alaska Native Tribal Health Consortium, tests pregnant mothers and newborns for contaminants and nutrients in their blood. Both of these programs help to better understand the potential pathways of contaminants into our bodies.

Where do these contaminants in humans come from? Although there are local sources of contaminants in Alaska, most of the contaminants detected in food arrive from other parts of the country and world through the air and water. Information is available for many store foods that have been tested for certain contaminants. However, there is limited contaminant data on traditional foods harvested on St. Paul Island. This study begins to answer questions regarding where these contaminants may be coming from. We must remember, however, that there are many other potential pathways for contaminants to enter our bodies.

Dietary choices are personal decisions. Individuals must use their own judgment to decide which foods to consume or not consume. Having good information to base a decision on is the first step to making healthy dietary choices.

HOW DO CONTAMINANTS ARRIVE IN ALASKA?

Although many think of Alaska as relatively untouched by humans, contaminants are being found in the air, water, fish, plants and wildlife. Although most contaminants arrive in Alaska from elsewhere, some are released locally. For example, there are former military sites located throughout the Aleutian and Pribilof Region, including St. Paul Island.

The Arctic Region is a settling area for contaminants which circulate around the globe and northward in air and ocean currents. For example, contaminants such as pesticides that are used in the southern hemisphere make their way into Alaska’s waters. They settle out in Arctic waters, sea ice

Air and ocean currents move northward towards Alaska from the lower latitudes. These currents carry with them contaminants from other parts of the world. (Graphic by David Johnson)
and land, where they remain for long periods and break down very slowly because of the colder climate.³

**HOW DO CONTAMINANTS GET INTO HALIBUT?**

Above is a diagram of a food chain for halibut. Contaminants in the water are taken up by the microscopic plankton. Biomagnification is a process whereby an animal eats another animal, consuming the contaminants stored in that animal. Contaminant values increase with each step in the food chain. In this case, the contaminants in plankton are passed up the food chain to halibut. (Graphics by David Johnson)

**METHODS**

**HOW WAS THIS STUDY CONDUCTED?**

**Community Involvement**

Essential to the success of this project was the involvement of St. Paul Island community members. Community members formed a Village Advisory Group (VAG) to help guide and direct the research goals and objectives of this study.

The St. Paul Island VAG was formed in 2001 and met regularly for the duration of the project. Participants in this group included a representative hunter, food preparer, clinician, youth, elder, and staff from the Tribal Ecosystem Conservation Office. This group was facilitated by the Traditional Foods Program Coordinator, hired by APIA. The coordinator’s role was to facilitate VAG meetings and to transfer information between the VAG and the Technical Advisory Group (TAG).

The TAG consisted of Tribal representatives from St. Paul Island and Atka, coordinators from both communities, APIA staff, researchers from other Tribal institutions, the university, the state, and federal agencies. The exchange between these two advisory groups was important in the research process. Together, these groups defined specific research goals and objectives, identified key outreach activities, foods of local importance to test for contaminants and nutrients, and appropriate methods of information sharing.

A variety of outreach activities were carried out to raise community awareness about dietary benefits and risks, including: a dietary consumption survey, a traditional foods fair, a play on traditional foods, radio programs, newsletters, a film series on diet, and school and Tribal Council presentations.

**Dietary Survey**

In the Spring of 2002, APIA conducted a dietary survey with 80 residents on St. Paul Island. The purpose of this survey was to measure food intake and nutrition on St. Paul Island and engage public discussions about subsistence preference, dietary changes, health changes, and community priorities and concerns over diet.

The dietary survey consisted of two instruments: a 24-hour recall and a semi-quantitative food frequency questionnaire. The food frequency questionnaire was performed once for each individual to assess the daily, weekly, monthly and yearly consumption of traditional and store-bought food items for a one-year time period. For the 24-hour recall survey, participants reported in
Pacific Halibut (*Hippoglossus stenolepis*) were caught in the summer of 2003 and donated by Native subsistence fishermen on St. Paul Island. These samples were wrapped as whole fish in food-grade plastic box liners, placed into a cooler and frozen. They were shipped to EnviroTest Laboratory in Canada and to the U.S. Department of Agriculture, respectively, for selected contaminant and nutrient analysis.

The majority of halibut samples were analyzed for nutrients and contaminants in muscle tissue after being baked at the lab with the skin on: the most common preparation method for halibut on St. Paul Island. Baking the halibut rather than testing raw halibut provides more accurate information on the actual contaminants consumed. The majority of past studies analyzing traditional foods for contaminants have analyzed the food raw.

**Contaminant Analysis**

The contaminants selected for analysis in this project included contaminants identified from human and animal biomonitoring in the Aleut region. The Maternal and Infant Monitoring Program’s list of contaminants in human blood was used as a guide for selecting contaminants.

EnviroTest Laboratory in Edmonton, Canada conducted the contaminant analysis on the St. Paul Island halibut. Fifteen halibut were analyzed for selected contaminants after being baked in the laboratory with the skin on. One halibut was analyzed both raw and baked with the skin on and off to see what effect baking and the presence of skin had on the concentration of contaminants. Persistent contaminants tend to

**Nutrient Analysis**

The United States Department of Agriculture (USDA) lab at Virginia Polytechnic State University conducted nutrient analysis on six samples of St. Paul Island halibut (three raw and three baked samples). A total of 78 common nutrients were analyzed. Most of the nutrients examined are believed to provide protective effects for human health (ie. amino acids, fatty acids, folates, and certain trace elements including selenium.)

The nutritional information in this report focuses on the results from the three baked halibut samples. Comparisons are drawn between selected nutrients in halibut and several foods commonly consumed on St. Paul Island.
concentrate in the fatty tissues such as skin in fish and blubber in sea mammals.

The halibut were tested in two phases. In the first phase, eight halibut were analyzed for eight different groups of chemicals (see Figure 1 on page 6). The remaining eight halibut were not tested for radionuclides, organotins and polycyclic aromatic hydrocarbons because these chemical groups were not detected in phase one.

Poly brominated diphenyl ethers (PBDEs) were detected in all of the samples, but are not covered in this report due to lab contamination issues and method refinement. PBDEs are flame retardants and are found in products such as TV sets, computers, building materials, foam cushioning, and textiles.

RESULTS

COMMUNITY INVOLVEMENT

The results of community involvement for this project are documented in a report prepared by the Alaska Center for Rural Health (ACRH) at the University of Alaska. ACRH was hired as a consultant by APIA to independently evaluate this project annually. The information reported below is taken from these reports.5

The Traditional Foods Project on St. Paul Island involved many community members. In particular, members of the Village Advisory Group (VAG) were highly involved in the sampling and research process. Fishermen were involved as they donated halibut for sampling. Other community members participated through the various events sponsored by the Traditional Foods Program. Though many participants interviewed for the evaluation were aware of the sampling aspect of the Traditional Foods program, everyone interviewed knew about the community outreach component.

The Traditional Foods Fair and a school play on traditional foods resonated most with the community. The St. Paul Island Traditional Foods Fair took place in April, 2004 and was a big community event. The purpose of the fair was to present the data from the halibut analysis to the community and present information on the benefits and risks of eating halibut. Community members enjoyed a potluck, entertainment by the local dancers, and a presentation on the benefits and risks of eating locally caught halibut. A program and posters were developed to help deliver the message.

The school play, entitled, “The Play” took place in May, 2003. The play compared traditional foods with store foods and involved many children from the community.

Several participants interviewed in the final evaluation of the project mentioned that as the children in the community got involved in events, the...
parents also benefited from the important information. High community participation helped increase local awareness of issues and resulted in a successful project.⁹

The St. Paul Island VAG met throughout the entire project and provided leadership and direction. The VAG was instrumental in all levels of decision making for this project. Examples of work completed by the VAG included: identifying relevant community outreach activities, reviewing dietary survey information, deciding on a traditional food to sample locally, reviewing halibut data and approving appropriate communication strategies for delivering data back to the community.

The Technical Advisory Group (TAG) was instrumental in providing technical information back to the VAG in order to successfully complete this project. Through regular meeting for the duration of the project, the TAG became more aware of local dietary issues. The TAG provided technical guidance throughout the project by identifying research goals and objectives, reviewing and commenting on the community sampling plan, reviewing and interpreting data, and addressing specific research questions and concerns from the community.

Community involvement and awareness for this project was also measured through a survey. A Food Perception Survey was passed out to St. Paul Island residents at the beginning of the project, and again at the project’s conclusion. The survey asked community members to give a “rating” of their perceptions of the nutritional value and the contaminants risk of a list of 39 traditional and store-bought foods. Forty community members filled out the survey before the project began, and 39 participants filled it out in the project’s final year. When comparing the results of these two surveys, community members filling out the survey at the end of the project rated several types of traditional foods higher for nutritional value and lower for contaminants compared to those who filled out the survey before the project began. Perceptions of seal oil and seal hearts, for example, changed in this direction. Fried bread, however, was a traditional food that people felt was less nutritious at the end of the project.

Similarly, several store-bought foods were rated lower for nutritional value and higher for contaminant risks in the project’s final year. Canned Beeferoni, for example, was found to be both less nutritious and more contaminated at the end of the project.

Though community residents rated halibut as quite nutritious and not particularly contaminated on both surveys, perception of nutritional value was slightly higher and, correspondingly, the perception of contaminants risk slightly lower in the final year.

#### THANK YOU ST. PAUL ISLAND VAG MEMBERS

The St. Paul Island VAG met throughout the entire project and provided leadership and direction. The VAG was instrumental in all levels of decision making for this project.

Jason Bourdukofsky
Mary Bourdukofsky
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Martin Stepelin
Phil Zavadil

![LEFT: Jeff and Jessica Kauffman enjoy traditional foods at the fair.](image)

![BELOW, LEFT: Macarius Mandregan cooks reindeer burgers for the fair.](image)

![BELOW: Ataqan Akun Dancers perform at the Traditional Foods Fair. (All photos by Blair Powless)](image)
DIETARY SURVEY

Nutritional Information from Dietary Survey

In general, the nutritional quality of the participants' reported diet was good on St. Paul Island. Foods eaten provided generous amounts of nutrients with the exception of calcium, fiber, and folate. However, total fat, saturated fat, monounsaturated fat, cholesterol, and simple carbohydrate levels were higher than recommended. These results are consistent with dietary trends among other Native American populations and among the US population as a whole.\(^7\)

Calcium

Mean intakes of calcium, important for bone health, were less than recommended for both men and women. The low calcium intakes of many participants in this study may be due in part to low consumption of dairy products. However, calcium consumption may have been underestimated because of incomplete information on the calcium content of subsistence foods. For example, calcium is found in canned fish due to the content of bones.

Fiber

Average intakes of fiber, useful in chronic disease prevention, were below recommended levels for men and women. Fiber is highest in fresh fruits and vegetables, both subsistence and store-bought, and whole grains and cereals.

Folate

Mean intakes of folate, important in protecting against heart disease and birth defects,\(^8\) were less than recommended for women. For most people in the US, the main sources of folate in the diet are fortified grain products such as bread and especially highly-fortified, ready-to-eat cereal. Other sources of folate include some kinds of berries, rose hips, leafy greens, asparagus, liver, and orange juice. Many subsistence plant foods have not been analyzed for folate content so we may have underestimated folate consumption in this survey.\(^9\)

Fat

Compared to USDA dietary recommendations, total fat intake is above the recommended 30% of total calories (38%). Thirty percent (30%) or less of fat is generally thought to reduce the incidence of fat-related cardiovascular disease. The current American dietary fat recommendations emphasize reducing total fat intake to less than 30% of dietary energy, and keeping saturated fat to less than 10% of total energy. Saturated fat consumption exceeded this recommendation with an average of 12% of total calories coming from saturated fat. Reported fat
consumption in this survey is similar to other surveys of US populations.

Carbohydrates
Another area of concern was the intake of carbohydrates. While the percentage of calories from carbohydrates was 43%, much of the carbohydrates reported were fluid-based (soda, Tang, Hi-C) which are rapidly absorbed, high in simple sugars, and have few nutrients. The role of fluid-based carbohydrates is being examined as to their contributing role in the increasing rates of diabetes mellitus (Type II) among Alaska Natives.

The trend in increased consumption of fluid-based carbohydrates has also been seen nationwide. Overall, energy intake from sweetened beverages increased 135% from 1977-2001 in the United States and was reduced by 38% from milk, with a 278 total calorie increase. These trends were associated with increased proportions of Americans consuming larger portions, more servings per day of sweetened beverage, and reductions in these same measures for milk.10

Other Nutrients
Nutrient levels that exceeded the Recommended Daily Allowance (RDA) by 130% or more for all RDA categories include protein, vitamin B-12, selenium, and iron. This means that the extra amounts of these nutrients found in halibut are considered safe to consume.

For Vitamin B-12, there is not enough data to establish an upper limit. The DRI book states “In the absence of UL’s extra caution may be warranted for consuming levels above recommended intakes.” No clear toxicity has been reported from daily oral ingestion of up to 100 mcg for B-12.11 All participants were well below this level.

The St. Paul Island Dietary Survey findings are consistent with previous studies in Alaska that reported high intakes of sugared beverages and the use of purchased staple foods such as rice, spaghetti, and bread. There was also a substantial reliance on many subsistence foods such as fish, terrestrial mammals, marine mammals, and wild plants. In contrast to some previous studies, few participants on St. Paul Island reported low intakes of vitamin A or vitamin B12. Consistent with previous studies, many participants on St. Paul Island reported high total fat and saturated fat intakes and low fiber, folate, and calcium intakes.
Subsistence foods continue to be an essential part of the diet for many St. Paul Island residents.

Based on the Food Frequency data, approximately 12% of the total meats consumed on St. Paul Island came from traditional protein sources.

Seasonal Consumption of Halibut in St. Paul
The table above shows the seasonal differences in halibut consumption on St. Paul Island according to the results of the dietary survey. Frequency describes how many participants stated that they consumed halibut during a particular month. Twenty-four participants identified that they consumed halibut during the month of July with the average intake during that month of .29 pounds per week. July, August, September and March were the months with the greatest frequency of halibut consumption.
Of the 80 participants surveyed, 1 person indicated that they “never” consume halibut. 25 participants

<table>
<thead>
<tr>
<th>Month</th>
<th>Frequency</th>
<th>Average lbs per week</th>
<th>Minimum lbs per week</th>
<th>Maximum lbs per week</th>
</tr>
</thead>
<tbody>
<tr>
<td>January</td>
<td>2</td>
<td>22</td>
<td>13</td>
<td>32</td>
</tr>
<tr>
<td>February</td>
<td>4</td>
<td>1.15</td>
<td>.19</td>
<td>3.75</td>
</tr>
<tr>
<td>March</td>
<td>11</td>
<td>30</td>
<td>.19</td>
<td>3.39</td>
</tr>
<tr>
<td>April</td>
<td>6</td>
<td>1.05</td>
<td>.20</td>
<td>3.5</td>
</tr>
<tr>
<td>May</td>
<td>2</td>
<td>.25</td>
<td>.17</td>
<td>.34</td>
</tr>
<tr>
<td>June</td>
<td>8</td>
<td>.42</td>
<td>.18</td>
<td>1.58</td>
</tr>
<tr>
<td>July</td>
<td>24</td>
<td>.29</td>
<td>.04</td>
<td>.64</td>
</tr>
<tr>
<td>August</td>
<td>18</td>
<td>.33</td>
<td>.04</td>
<td>1.02</td>
</tr>
<tr>
<td>September</td>
<td>10</td>
<td>.34</td>
<td>.09</td>
<td>.61</td>
</tr>
<tr>
<td>October</td>
<td>2</td>
<td>.59</td>
<td>.17</td>
<td>1.02</td>
</tr>
<tr>
<td>November</td>
<td>0</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>December</td>
<td>2</td>
<td>.29</td>
<td>.25</td>
<td>.32</td>
</tr>
</tbody>
</table>
indicated that they consume halibut “year round”. Fifty-four participants indicated that they consume halibut “seasonally”. The table is the seasonal intake per month for those that indicated seasonal consumption. (Remember that participants could indicate more than one month so the frequency column will not add up to 54.)

Participants ate the greatest amount of halibut during the months of February, March and April. The maximum number of pounds eaten during these months was 15 pounds (or 3.75 pounds per week), which roughly works out to .48 pounds per day. There is actually only one participant that indicated that he/she consumed approximately 3.5 pounds of halibut per week in February, March and April. It is important to keep in mind that this may have been an inter-viewer error or the participant may not have understood the question. The number of participants consuming halibut during these months was low but those that did consume halibut ate large amounts.

**NUTRIENT ANALYSIS: READING THE FOOD LABEL**

The nutrition facts food label gives you information about which nutrients are in the food. Nutrient labels are required on store-bought foods, but are not usually available for traditional foods. Your body needs the right combination of nutrients to work properly, grow, and fight disease. The nutrient label shown below is specific to St. Paul Island halibut. The information on the label is the average of three halibut samples collected near St. Paul Island and dry baked at the lab with the skin on. The Ball Park Franks label is the nutrition label for one brand of hot dog sold at the local store on St. Paul Island. It is a blend of beef, pork, and turkey.

The percentages on food labels are based on recommended daily allowances – meaning the average amount of a nutrient a person should eat each day. Some percent daily values are based on the amount of calories and energy a person needs. These include carbohydrates, proteins, and fat. Other percent daily values – like those for sodium, potassium, vitamins, and minerals – stay the same no matter how many calories a person eats. For example, halibut contains 5% of the recommended daily value for total fat. This means that a person eating a 2000 calorie per day diet gets only 5% of their fat for the day from one serving of halibut.

<table>
<thead>
<tr>
<th>Halibut (baked) St. Paul</th>
<th>Ball Park Franks (beef, pork, turkey)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Serving Size</strong></td>
<td>3.4 oz (100g or @ 1/4 pound)</td>
</tr>
<tr>
<td><strong>Serving Size</strong></td>
<td>2 franks – 4 oz. (112 g)</td>
</tr>
<tr>
<td><strong>Amount per Serving</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Calories</strong></td>
<td>119</td>
</tr>
<tr>
<td><strong>Calories from Fat</strong></td>
<td>27</td>
</tr>
<tr>
<td><strong>% Daily Value</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Total Fat</strong></td>
<td>3g</td>
</tr>
<tr>
<td><strong>Saturated Fat</strong></td>
<td>.5g</td>
</tr>
<tr>
<td><strong>Cholesterol</strong></td>
<td>75mg</td>
</tr>
<tr>
<td><strong>Sodium</strong></td>
<td>87mg</td>
</tr>
<tr>
<td><strong>Total Carbohydrates</strong></td>
<td>1.4g</td>
</tr>
<tr>
<td><strong>Dietary Fiber</strong></td>
<td>0g</td>
</tr>
<tr>
<td><strong>Sugars</strong></td>
<td>0g</td>
</tr>
<tr>
<td><strong>Protein</strong></td>
<td>22g</td>
</tr>
<tr>
<td><strong>Vitamin A</strong></td>
<td>n/a</td>
</tr>
<tr>
<td><strong>Vitamin C</strong></td>
<td>n/a</td>
</tr>
<tr>
<td><strong>Calcium</strong></td>
<td>3%</td>
</tr>
<tr>
<td><strong>Iron</strong></td>
<td>2%</td>
</tr>
<tr>
<td><strong>Selenium</strong></td>
<td>87%</td>
</tr>
<tr>
<td><strong>Vitamins A and C were not tested for in the St. Paul halibut, however, USDA data for Pacific Halibut shows Vitamin A, 4% and Vitamin C, 0%</strong></td>
<td></td>
</tr>
<tr>
<td><strong>% Percent Daily Values are based on a 2,000 Calorie diet. Your daily values may be higher or lower depending on your calorie needs</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Calories:</strong> 2,000</td>
<td>2,500</td>
</tr>
<tr>
<td><strong>Total Fat</strong></td>
<td>Less than 65g</td>
</tr>
<tr>
<td><strong>Sat Fat</strong></td>
<td>Less than 20g</td>
</tr>
<tr>
<td><strong>Cholesterol</strong></td>
<td>Less than 300mg</td>
</tr>
<tr>
<td><strong>Sodium</strong></td>
<td>Less than 2,400mg</td>
</tr>
<tr>
<td><strong>Total Carbohydrate</strong></td>
<td>300g</td>
</tr>
<tr>
<td><strong>Dietary Fiber</strong></td>
<td>25g</td>
</tr>
<tr>
<td><strong>Vitamin A</strong></td>
<td>0%</td>
</tr>
<tr>
<td><strong>Vitamin C</strong></td>
<td>12%</td>
</tr>
<tr>
<td><strong>Calcium</strong></td>
<td>8%</td>
</tr>
<tr>
<td><strong>Iron</strong></td>
<td>8%</td>
</tr>
<tr>
<td><strong>Selenium</strong></td>
<td>n/a</td>
</tr>
<tr>
<td><strong>Sodium</strong></td>
<td>1120mg</td>
</tr>
<tr>
<td><strong>Total Carbohydrates</strong></td>
<td>6g</td>
</tr>
<tr>
<td><strong>Dietary Fiber</strong></td>
<td>0g</td>
</tr>
<tr>
<td><strong>Sugars</strong></td>
<td>6g</td>
</tr>
<tr>
<td><strong>Protein</strong></td>
<td>12g</td>
</tr>
<tr>
<td><strong>Vitamin A</strong></td>
<td>0%</td>
</tr>
<tr>
<td><strong>Vitamin C</strong></td>
<td>12%</td>
</tr>
<tr>
<td><strong>Calcium</strong></td>
<td>8%</td>
</tr>
<tr>
<td><strong>Iron</strong></td>
<td>8%</td>
</tr>
<tr>
<td><strong>Selenium</strong></td>
<td>n/a</td>
</tr>
<tr>
<td><strong>Sodium</strong></td>
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<tr>
<td><strong>Total Carbohydrates</strong></td>
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<tr>
<td><strong>Dietary Fiber</strong></td>
<td>0g</td>
</tr>
<tr>
<td><strong>Sugars</strong></td>
<td>6g</td>
</tr>
<tr>
<td><strong>Protein</strong></td>
<td>12g</td>
</tr>
</tbody>
</table>

*Percent Daily Values are based on a 2,000 Calorie diet. Your daily values may be higher or lower depending on your calorie needs*
In comparison, if you consume about the same serving size of Ball Park Franks, you have eaten half of the recommended intake of fat for the day. If you compare the two nutrition labels for calories from fat, saturated fat, sodium and protein, you can quickly see that halibut is a much healthier alternative to the Ball Park Franks.

### Understanding Nutrients on the Food Label

<table>
<thead>
<tr>
<th>NUTRIENT</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>TOTAL FAT</strong></td>
<td><em>Halibut is low in fat.</em> Fats supply energy and essential fatty acids, and help absorb fat-soluble vitamins. You need some fat in the food you eat, but too much fat can increase the risk for coronary heart disease. It is recommended that total fat intake be 20 to 35 percent of calories, with most fats coming from foods containing polyunsaturated and monounsaturated fatty acids, such as fish, marine mammals, nuts, and vegetable oils. Less than 10 percent of calories should be from saturated fats, such as those from beef, chicken and pork. <em>12</em> Fat stored in our bodies is used for insulation, connective tissues and as energy when needed.</td>
</tr>
<tr>
<td><strong>CARBOHYDRATES</strong></td>
<td><em>Halibut is not a significant source of carbohydrates.</em> Good sources of carbohydrates include potatoes, grains, pasta, beans, fruits, and vegetables. Carbohydrates are an important fuel source for the body. They fuel the brain and red blood cells. Simple carbohydrates such as candy and soda can be quickly turned into fat and stored for future energy use. Intake of too many simple carbohydrates in a diet can be hard on your body and has been shown to be a cause of obesity and late-onset diabetes.</td>
</tr>
<tr>
<td><strong>CHOLESTEROL</strong></td>
<td><em>Halibut is relatively low in cholesterol.</em> Cholesterol helps to make cell walls, hormones, vitamin D and acids for digestion. Cholesterol comes from animals and is not found in fruits, vegetables or grains. High cholesterol is a leading risk factor for coronary heart disease.</td>
</tr>
<tr>
<td><strong>SODIUM</strong></td>
<td><em>Halibut is low in sodium.</em> Sodium is an essential mineral for your body, however too much sodium is unhealthy. Sodium helps your body maintain a balance of fluids. It also functions to send nerve impulses and absorb some nutrients. Some sodium occurs naturally in food, but most is added during cooking. Most of the sodium you consume comes from processed foods and foods eaten at restaurants. Recommended consumption is less than 1 teaspoon of salt per day (2,300 mg sodium). A diet high in sodium is often linked to high blood pressure.</td>
</tr>
<tr>
<td><strong>SUGARS</strong></td>
<td><em>Halibut is sugar free.</em> This is good because many processed foods are high in sugar. Sugars are naturally found in fruits and grains. Our bodies use sugars for energy. We also store sugar in the form of fat for future use. With sugary foods, the rule is moderation. Eating a great deal of sugar will 1- increase blood glucose to unacceptable levels; 2- provide calories empty of nutrients; and 3- provide excess fat and weight that may result in obesity, diabetes, blindness, amputations and heart disease.</td>
</tr>
<tr>
<td><strong>PROTEIN</strong></td>
<td><em>Halibut is high in protein.</em> Protein’s biggest job is to build, maintain, and replace the tissues in your body. Protein is important for growth and it provides energy. Halibut provides 44% of your daily needs for protein without the added fat of most meat.</td>
</tr>
<tr>
<td><strong>SELENIUM</strong></td>
<td><em>Halibut is an excellent source of Selenium.</em> Selenium is a trace mineral that is essential for normal functioning of the immune system and thyroid gland. St. Paul halibut provides 87% of your daily needs for Selenium. Selenium is a powerful antioxidant and many studies have suggested that people with greater intakes of selenium are less likely to develop some forms of cancer such as those of the lung, prostate, stomach and breast. In addition, higher selenium intakes have been associated with lower risks for heart disease and decreased pain from rheumatoid arthritis. Many studies suggest that selenium may help reduce the toxic effects of methylmercury (the organic form of mercury), however, the mechanisms by which is does this are not fully understood. <em>13</em> The major food sources of selenium are seafood, eggs, and meats, especially organ meats.</td>
</tr>
</tbody>
</table>

*Remember, however, that adding too much salt, fat, and/or other ingredients in your cooking will affect the nutritional quality of your halibut.*
Some data is presented in parts per million (ppm). This is also an extremely small amount, but 1 part per million is 1,000 times larger than one part per billion.

**CONSUMPTION GUIDELINES**

Consumption guidelines are used in the risk assessment phase of determining how much fish containing trace levels of contaminants can be consumed. Several organizations have guidelines for how much of a contaminant in food is safe to consume. The confusing message is that organizations don’t always agree on the amounts. Consumption guidelines vary between governmental agencies because the health effects of exposure to low levels of these chemicals are uncertain and different agencies have different priorities. Also, agencies use different reports and safety factors to determine their guidelines. For example, for mercury, if the fish you are consuming has 50 ppb of mercury, you could safely consume the following amounts depending on which agency’s guideline you use:

- **Agency for Toxic Substances and Disease Registry (ATSDR)** – 6 pounds of the fish per week.

---

**TABLE 1**

**Nutrient Profile Comparison of St. Paul Pacific Halibut, Other Pacific Halibut and Greenlandic Halibut (per 100 grams)**

<table>
<thead>
<tr>
<th></th>
<th>Kcal</th>
<th>Prot (g)</th>
<th>Total fat (g)</th>
<th>Chol (mg)</th>
<th>Sat fat (g)</th>
<th>Na (mg)</th>
<th>Total CHO* (g)</th>
<th>Ca (mg)</th>
<th>Fe (mg)</th>
<th>Se (mcg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>St. Paul halibut</td>
<td>119</td>
<td>22</td>
<td>2.7</td>
<td>75</td>
<td>0.5</td>
<td>87</td>
<td>1.4</td>
<td>33</td>
<td>0.4</td>
<td>60.6</td>
</tr>
<tr>
<td>Pacific halibut**</td>
<td>113</td>
<td>23</td>
<td>1.5</td>
<td>66</td>
<td>0.4</td>
<td>101</td>
<td>0</td>
<td>17</td>
<td>0.3</td>
<td>56</td>
</tr>
<tr>
<td>Greenlandic halibut</td>
<td>203</td>
<td>23</td>
<td>11.7</td>
<td>62</td>
<td>4.3</td>
<td>73</td>
<td>0</td>
<td>41</td>
<td>0.7</td>
<td>45</td>
</tr>
</tbody>
</table>

* CHO = carbohydrates

** Values for Pacific and Atlantic halibut in Nutrition Data Systems (NDS) are identical.

The analysis of the St. Paul halibut was computed baked with the skin on. However, the analysis of the other Pacific halibut and Greenlandic halibut was computed raw without skin. This may account for the few differences seen between St. Paul Pacific halibut and the other Pacific halibut, especially for total fat and cholesterol levels. The largest fatty layer for cold water fish is right beneath the skin. Preparing the halibut with the skin on would lessen the amount of fat lost during preparation. Even if the skin is removed before consumption, the amount of fat remaining in the fish would likely be higher. Consumption of the skin may provide additional nutrients such as fat, calcium and selenium; although the exact nutrient composition of halibut skin is unknown.

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**CONTAMINANT ANALYSIS:**

**READING THE RESULTS**

**Parts per billion (ppb)**

Some of the tables and figures presented in the contaminant analysis section report the data in the unit of parts per billion (ppb). This is the unit of measurement used when looking at the amount of contaminant in a food item. It is an extremely small amount. To give you an idea of how small a part per billion is, think of the following examples. One part per billion (ppb) equals:

- One penny in ten million dollars
- One second in 32 years
- One inch in 16,000 miles (That’s the same as one inch of 356 trips around St. Paul Island’s shoreline!)

Some data is presented in parts per million (ppm). This is also an extremely small amount, but 1 part per million is 1,000 times larger than one part per billion.

**One billion is such a high number that if you started counting to 1 billion right now, it would take you over 60 years to finish counting!**

---

**CONSUMPTION GUIDELINES**

Consumption guidelines are used in the risk assessment phase of determining how much fish containing trace levels of contaminants can be consumed. Several organizations have guidelines for how much of a contaminant in food is safe to consume. The confusing message is that organizations don’t always agree on the amounts. Consumption guidelines vary between governmental agencies because the health effects of exposure to low levels of these chemicals are uncertain and different agencies have different priorities. Also, agencies use different reports and safety factors to determine their guidelines. For example, for mercury, if the fish you are consuming has 50 ppb of mercury, you could safely consume the following amounts depending on which agency’s guideline you use:

- **Agency for Toxic Substances and Disease Registry (ATSDR)** – 6 pounds of the fish per week.
- US Environmental Protection Agency (EPA) – 2 pounds per week
- Health Canada and the World Health Organization (WHO) – 4 pounds per week.

Consumption guidelines are based strictly on the risk and do not include a consideration of the benefits of eating these foods. In addition, the guidelines also have uncertainty factors associated with them because scientists are not sure what levels can cause harm. For example, the EPA consumption guideline for mercury have a 10-fold uncertainty factor.15

### HEALTH ENDPOINTS

The US Environmental Protection Agency (EPA) provides two different health endpoints for risk-based screening of chemical concentrations detected in fish: chronic health endpoints and cancer endpoints. The Alaska Division of Public Health places more importance on the chronic endpoints for PCBs because they feel that the cancer endpoints are overly

### CONTAMINANTS DESCRIBED IN REPORT

This report focuses mostly on the following three chemical groups:
- Metals (in particular, mercury)
- Pesticides
- Polychlorinated biphenyls (PCBs)

<table>
<thead>
<tr>
<th>Chemical</th>
<th>What is it?</th>
<th>Where is it found?</th>
<th>How does it get to Alaska?</th>
<th>What are the health effects?</th>
<th>Where does it concentrate in animals?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mercury</td>
<td>Mercury is a metal. Some microorganisms can turn mercury into methyl-mercury, a highly toxic form.</td>
<td>Mercury naturally occurs in some rocks, soil and water. Burning fuel from coal has increased the amount of mercury in the environment.</td>
<td>Mercury arrives mostly through air currents from Europe and Asia. Mercury also naturally occurs in some rocks in Alaska.</td>
<td>In high doses, mercury is toxic to living things, causing damage to the brain and nerves.</td>
<td>Metals tend to accumulate in protein tissues (organs) and bone rather than fat. Mercury tends to build up in the liver. Mercury is usually higher in fish than in land animals.</td>
</tr>
<tr>
<td>Organic Pesticides</td>
<td>Organic pesticides are compounds that stay in the environment for a long time. The most persistent pesticides contain chlorine.</td>
<td>Pesticides are used to kill unwanted plants and animals such as insects, rodents, plants, and fungi.</td>
<td>Pesticides arrive mostly from the lower latitudes and are carried to the Arctic by wind and ocean currents.</td>
<td>The toxic effect of most pesticides is on the nervous system and the liver, and several pesticides interfere with human and animal reproduction.</td>
<td>Pesticides tend to accumulate in fatty tissues. Older and larger animals and animals higher up in the food chain will have more pesticides.</td>
</tr>
<tr>
<td>Polychlorinated biphenyls (PCBs)</td>
<td>PCBs are chemically stable organic compounds that do not break down easily in the environment. PCBs are man-made and were first manufactured in 1929; they are no longer produced in North America.</td>
<td>PCBs were used worldwide as coolants and lubricants in transformers, capacitors, and other electrical equipment because of their resistance to heat.</td>
<td>Most of the PCBs in the North come from other parts of the world, carried by wind and ocean currents. Some may come from local sources, such as old power plants and military bases.</td>
<td>PCBs suppress the immune system, making people more likely to become ill if they are exposed to infections. They can also disturb behavior and reproduction in birds, fish and mammals.</td>
<td>PCBs tend to accumulate in the fatty tissues of animals (i.e. fat of fish and blubber of marine mammals). Older animals and animals higher up in the food chain will have more PCBs.</td>
</tr>
</tbody>
</table>
conservative and likely to overestimate actual risk.\textsuperscript{16} Also, recent research suggests that fish consumption may protect against some forms of cancer. EPA’s chronic health guidelines are also very conservative in that they contain large uncertainty factors. Allowable concentrations are often 100- to 1000-fold below the concentrations that have produced observable health effects in laboratory animals. For example, if 1000 teaspoons of a chemical was given to a cow and caused the cow to get sick, scientists might say that one teaspoon of that chemical would be safe for humans to consume. For PCBs and mercury, the chronic health guidelines consider possible reproductive and developmental effects for the developing fetus, the most sensitive endpoint.\textsuperscript{17}

**CONTAMINANT ANALYSIS**

The average weight of the 16 halibut analyzed was 9.3 pounds. Although small, this size of halibut is typically consumed for subsistence. Larger halibut will typically have a greater concentration of contaminants.

During phase one of the analysis, PAHs, organotins, dioxins and furans were not detected in the eight halibut analyzed. Compounds that were not detected are not included in the summary statistics. One radionuclide (polonium 210) was detected at a very low level in one sample. Polonium is naturally occurring and is not expected to have come from underground nuclear testing on Amchitka Island. PAHs, organotins, and radionuclides were not analyzed in the remaining eight halibut (second phase of analysis).

**The effect of baking halibut**

The results of the cooking and preparation method are shown in Figures 2 and 3. The results for PCBs and mercury are shown.

Figure 2 shows the concentration of summed PCBs in halibut. PCBs were measured in both raw and cooked halibut and with the skin either on or off. This figure demonstrates two things: 1) When the skin on the halibut is removed, the concentration of PCBs is greatly reduced. This is because the PCBs concentrate in the fat and by removing the skin, the fat is also removed; 2) If the skin is kept on the halibut, baking greatly reduces the concentration of PCBs since the fat is baked off. The level of PCBs in halibut is very low for each preparation method. The level of PCBs is lower in fish prepared without the skin because PCBs concentrate in the fat, which is removed with the skin. Cooked fish have lower levels of PCBs because the fat drips out of the fish when it is cooked.

Figure 3, Mercury, on the other hand, is mainly present in the muscle and cooking and/or skinning had very little effect on the concentration.
Results

Metals
All metals are elements which naturally occur in the environment. Some of these elements (calcium, copper, magnesium, manganese, phosphorus, potassium, selenium, and zinc) are essential for the normal functioning of the body. The remaining elements; arsenic, lead, cadmium, and mercury can have negative implications to human health.

The most common form of arsenic in fish is not considered toxic. Arsenic in fish is bound to organic molecules that are not easily absorbed when ingested. Three halibut were analyzed for total arsenic. Total arsenic is the total of the inorganic (toxic) and organic (non-toxic) forms of arsenic. Only the non-toxic form of arsenic was detected in the three samples.

- Only relatively non-toxic forms of arsenic were detected.
- The levels of lead and cadmium found were very low.
- The levels of mercury found were very low.

<table>
<thead>
<tr>
<th>CHEMICAL</th>
<th>NUMBER ANALYZED</th>
<th>NUMBER OF DETECTIONS</th>
<th>DETECTION LIMIT</th>
<th>MEAN</th>
<th>STANDARD DEVIATION</th>
<th>MINIMUM</th>
<th>MAXIMUM</th>
</tr>
</thead>
<tbody>
<tr>
<td>ARSENIC (TOTAL)</td>
<td>16</td>
<td>16</td>
<td></td>
<td>2.04</td>
<td>0.61</td>
<td>1.12</td>
<td>3.46</td>
</tr>
<tr>
<td>BARIUM</td>
<td>8</td>
<td>1</td>
<td>0.05</td>
<td>0.12</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BORON</td>
<td>8</td>
<td>4</td>
<td>0.6</td>
<td>0.75</td>
<td>0.24</td>
<td>0.6</td>
<td>1.1</td>
</tr>
<tr>
<td>CADMIUM</td>
<td>16</td>
<td>3</td>
<td>0.02</td>
<td>0.03</td>
<td>0.01</td>
<td>0.02</td>
<td>0.04</td>
</tr>
<tr>
<td>CALCIUM</td>
<td>15</td>
<td>15</td>
<td></td>
<td>139</td>
<td>76</td>
<td>54</td>
<td>351</td>
</tr>
<tr>
<td>CESIUM</td>
<td>8</td>
<td>8</td>
<td></td>
<td>0.03</td>
<td>0.01</td>
<td>0.02</td>
<td>0.05</td>
</tr>
<tr>
<td>CHROMIUM</td>
<td>16</td>
<td>0</td>
<td>0.1</td>
<td>0.4</td>
<td>0.49</td>
<td>0.1</td>
<td>1.8</td>
</tr>
<tr>
<td>COPPER</td>
<td>16</td>
<td>11</td>
<td>0.1</td>
<td>0.05</td>
<td>0.02</td>
<td>0.028</td>
<td>0.096</td>
</tr>
<tr>
<td>IRON</td>
<td>16</td>
<td>0</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LEAD</td>
<td>16</td>
<td>1</td>
<td>0.04</td>
<td>0.28</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MAGNESIUM</td>
<td>16</td>
<td>16</td>
<td></td>
<td>276</td>
<td>23.95</td>
<td>226</td>
<td>318</td>
</tr>
<tr>
<td>MANGANESE</td>
<td>16</td>
<td>4</td>
<td>0.2</td>
<td>0.05</td>
<td>0.53</td>
<td>0.2</td>
<td>1.4</td>
</tr>
<tr>
<td>MERCURY (TOTAL)</td>
<td>16</td>
<td>16</td>
<td></td>
<td>0.05</td>
<td>0.02</td>
<td>0.028</td>
<td>0.096</td>
</tr>
<tr>
<td>PHOSPHORUS</td>
<td>16</td>
<td>16</td>
<td></td>
<td>2417</td>
<td>217</td>
<td>1940</td>
<td>2680</td>
</tr>
<tr>
<td>POTASSIUM</td>
<td>16</td>
<td>16</td>
<td></td>
<td>4618</td>
<td>450</td>
<td>3630</td>
<td>5280</td>
</tr>
<tr>
<td>RUBIDIUM</td>
<td>8</td>
<td>8</td>
<td></td>
<td>0.96</td>
<td>0.15</td>
<td>0.7</td>
<td>1.1</td>
</tr>
<tr>
<td>SELENIUM</td>
<td>16</td>
<td>16</td>
<td></td>
<td>0.53</td>
<td>0.15</td>
<td>0.4</td>
<td>0.8</td>
</tr>
<tr>
<td>SODIUM</td>
<td>16</td>
<td>16</td>
<td></td>
<td>725</td>
<td>138</td>
<td>516</td>
<td>1010</td>
</tr>
<tr>
<td>STRONTIUM</td>
<td>8</td>
<td>8</td>
<td></td>
<td>0.07</td>
<td>0.16</td>
<td>0.5</td>
<td>0.99</td>
</tr>
<tr>
<td>TIN</td>
<td>8</td>
<td>1</td>
<td>0.05</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TITANIUM</td>
<td>8</td>
<td>6</td>
<td></td>
<td>0.08</td>
<td>0.01</td>
<td>0.06</td>
<td>0.09</td>
</tr>
<tr>
<td>ZINC</td>
<td>16</td>
<td>16</td>
<td></td>
<td>6.11</td>
<td>1.92</td>
<td>4</td>
<td>12.6</td>
</tr>
</tbody>
</table>
**Polychlorinated Biphenyls (PCBs)**

PCBs were detected in all of the 16 halibut samples analyzed. The mean or average level of PCBs in the St. Paul halibut was 2 parts per billion. **This is a very low level.** The EPA guideline for halibut is 5.9 ppb. This means that the average amount of PCBs detected in the halibut was almost 4 ppb less than the EPA’s limit for unrestricted consumption. In other words, halibut that are higher than 5.9 ppb in PCBs will have restrictions on consumption based only on risk assessment. On the other hand, for halibut that are less than 5.9 ppb in PCBs, the amount of halibut you can consume continues to increase over 16 meals/month as the amount of PCBs decreases.

**Pesticides**

A total of 11 chemicals were detected of the 22 analyzed. **The concentration of all of these chemicals was very low.** Six pesticides were detected in more than 2 halibut. All of the samples were well below the EPA’s guidelines for unrestricted consumption.

---

**TABLE 3**

PCB and pesticide concentrations detected in halibut from St. Paul Island (ug/kg, ppb, wet weight)

<table>
<thead>
<tr>
<th>CHEMICAL</th>
<th>NUMBER ANALYZED</th>
<th>NUMBER OF DETECTIONS</th>
<th>DETECTION LIMIT</th>
<th>MEAN</th>
<th>STANDARD DEVIATION</th>
<th>MINIMUM</th>
<th>MAXIMUM</th>
<th>UNRESTRICTED CONSUMPTION GUIDELINES USEPA*</th>
</tr>
</thead>
<tbody>
<tr>
<td>PCBs</td>
<td>16</td>
<td>16</td>
<td>0.5</td>
<td>2.114</td>
<td>1.161</td>
<td>0.188</td>
<td>4.11</td>
<td>5.9</td>
</tr>
<tr>
<td>PESTICIDES</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a-BHC</td>
<td>16</td>
<td>9</td>
<td>0.05</td>
<td>0.87</td>
<td>0.41</td>
<td>0.6</td>
<td>1.9</td>
<td>147</td>
</tr>
<tr>
<td>b-BHC</td>
<td>16</td>
<td>2</td>
<td>0.5</td>
<td>1.1</td>
<td>0.28</td>
<td>0.9</td>
<td>1.3</td>
<td></td>
</tr>
<tr>
<td>g-BHC</td>
<td>16</td>
<td>2</td>
<td>0.5</td>
<td>0.67</td>
<td>0.07</td>
<td>0.62</td>
<td>0.72</td>
<td></td>
</tr>
<tr>
<td>Heptachlor</td>
<td>16</td>
<td>1</td>
<td>0.5</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dieldrin</td>
<td>16</td>
<td>8</td>
<td>0.5</td>
<td>1.14</td>
<td>0.55</td>
<td>0.5</td>
<td>1.8</td>
<td>15</td>
</tr>
<tr>
<td>Sum DDTs</td>
<td>16</td>
<td>11</td>
<td>0.5</td>
<td>2.26</td>
<td>0.99</td>
<td>0.75</td>
<td>3.79</td>
<td>15</td>
</tr>
<tr>
<td>Endrin</td>
<td>16</td>
<td>1</td>
<td>0.5</td>
<td>0.5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hexachlorobenzene</td>
<td>16</td>
<td>8</td>
<td>0.5</td>
<td>1.06</td>
<td>0.39</td>
<td>0.64</td>
<td>1.7</td>
<td>230</td>
</tr>
<tr>
<td>Trans-nonchlor</td>
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<td>8</td>
<td>0.5</td>
<td>0.88</td>
<td>0.3</td>
<td>0.56</td>
<td>1.4</td>
<td>150</td>
</tr>
</tbody>
</table>

* Unrestricted Consumption – The US Environmental Protection Agency (EPA) defines unrestricted consumption (based on non cancer end-point) as eating more than 16 meals of halibut per month. This is assuming an 8 ounce or 1/2 pound meal size. This means that you can safely eat over 16 meals per month.18
DISCUSSION

NUTRIENTS
Comparing nutrients in halibut with store foods

Four foods were selected for comparison of nutrients with St. Paul Island halibut. The serving size used for comparison of the foods is 100 grams or about 1/4 pound. The decision to select these specific foods was based on information from the local store and results from the St. Paul Dietary Survey conducted in 2003.

**Hot Dogs:** The top three meat products purchased at the St. Paul Island AC store in the summer of 2004 were hot dogs, canned ham and ground beef. 380 pounds of hot dogs on average were purchased in one month. This report uses a hot dog combo, a frankfurter using meat from various sources: beef, chicken, pork.

**Sausage:** The results from the St. Paul Dietary Survey in 2003 showed that sausage was the most frequently consumed meat item from the store in people’s diet. This report uses Brown and Serve pork sausages for comparison.

**Tuna:** Tuna did not appear in the top ten meat items purchased from the local store, but we wanted to compare halibut with another fish product sold in the store that provides a healthy alternative to halibut.

**Eggs:** Chicken eggs were also in the top 20 most frequently consumed foods from the store.

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**FIGURE 4:**

Protein serves as the major structural component of all cells in the body. It is important for proper growth and development. **Halibut is high in protein as is tuna.**

**FIGURE 5:**

Calories provide a measure of how much energy you get from a serving of food. Many Americans consume more calories than they need without meeting recommended intakes for a number of nutrients. Eating too many calories is linked to overweight and obesity. **Halibut, tuna and eggs are low in calories. Hot dogs and sausages are higher in calories.**
“Good fats” versus “bad fats”
Omega-3 fatty acids are good for the heart. They are needed for normal growth and development and may lead to decreases in cardiovascular disease, diabetes, hypertension, arthritis, autoimmune diseases, and may also improve mental health. Halibut, other fish and marine mammals have high levels of omega-3 fatty acids.

Saturated fats raise cholesterol levels and contribute to heart disease and strokes. They tend to come from animal-based foods like butter, meat, eggs, and milk. The American Heart Association recommends consuming no more than 7% to 10% of total calories in a day from saturated fatty acids.19

Figure 6: Halibut is high in omega-3 fatty acids compared to the store foods. It has over twice as much of the “good” fats as do tuna and hot dogs.

Figure 7: Halibut is very low in saturated fats as is tuna. Hot dogs and sausage are high in these “bad” fats.
Results

CONTAMINANTS

The US Environmental Protection Agency (EPA) has established guidelines for assessing the safety of consuming fish containing trace levels of contaminants. The guidelines consist of four stages: sampling and analysis, risk assessment, risk management, and risk communication. In the risk assessment stage, the analytical data is compared to conservative risk-based screening values to determine potential risk. If the average value of a chemical detected in fish is above the risk-based screening value, then the risk management stage occurs. In the risk management stage, local information is considered such as the health benefits of fish consumption, the availability of nutritious alternative foods, and the social, cultural, and economic importance of fish to determine optimum public health advice.

Consumption guidelines vary between governmental agencies because the health effects of exposure to low levels of these chemicals are uncertain. Various guidelines for PCBs and mercury are given in Table 4 above.

<table>
<thead>
<tr>
<th>Chemical</th>
<th>ATSDR (Agency for Toxic Substances and Disease Registry)</th>
<th>USEPA (US Environmental Protection Agency)</th>
<th>HEALTH CANADA</th>
</tr>
</thead>
<tbody>
<tr>
<td>PCBs (2.2)</td>
<td>9.8</td>
<td>9.8</td>
<td>476</td>
</tr>
<tr>
<td>Mercury (50)</td>
<td>6</td>
<td>2</td>
<td>4</td>
</tr>
</tbody>
</table>

*Based on agency consumption guidance. These values include various uncertainty factors and do not include consideration of the benefits of fish consumption.

- For the levels of PCBs detected in St. Paul Island halibut, guidelines based strictly on risk assessment say that people can safely eat between 10 and 400 pounds of St. Paul Island halibut per week every week for the rest of your life.

- For levels of mercury detected in St. Paul Island halibut, guidelines based strictly on risk assessment say that people can safely eat between two to six pounds of halibut per week every week of your life.

- Based on the dietary survey performed on St. Paul Island, the average number of pounds of halibut consumed per week for all seasons is well below all agency guidelines described in Table 4 for allowable consumption (refer to the chart on “Seasonal Consumption of Halibut in St. Paul” on page 10).

These amounts are based on the most sensitive members of the population, pregnant mothers.
Organic Pesticides and PCBs in St. Paul Halibut

Figures 8 and 9 at right compare the average concentration of pesticides (detected in three or more halibut) and PCBs for St. Paul Island halibut. The average concentration of pesticides and PCBs were below the EPA’s guidelines for unrestricted consumption (defined as more than 16 8-ounce meals per month).

Comparing St. Paul Island Halibut to Other Fish

Below are two figures comparing St. Paul Island halibut with other halibut tested for mercury and PCBs. St. Paul Island halibut was analyzed for contaminants after being baked with the skin on. Most of the comparative halibut were tested as raw skinless fillets. Baking decreased the concentration of other samples were analyzed raw. If the other samples had been baked, this may have lowered their concentrations of PCBs. (Refer to Figures 2 and 3 on page 15 to better understand the effect baking may have on the level of contaminants analyzed.)

The level of mercury in the St. Paul Island halibut analyzed is similar to levels of mercury detected in Alaska salmon and lower than mercury detected in canned tuna you buy at the store (Figure 10). For comparison, the FDA action level for commercial sale is 1000 ppb. The statewide mercury level in halibut was higher because bigger fish were analyzed. These fish were commercial sized fish between 20-100 pounds.23 The St. Paul Island

Half of the world’s mercury emissions come from Asia. The source of emissions is coal combustion to produce electricity and heat.22

PCBs, but had little effect on mercury. Therefore, the concentrations reported below are artificially high for PCBs compared to St. Paul Island because the

FIGURE 8
Comparison of DDTs, Dieldrin, and PCBs Levels in Halibut with the EPA Guidelines for Unrestricted Consumption (>16 meals per month) (chronic)

FIGURE 9
Comparison of Total Chlordanes, Hexachlorobenzene, and α-BHC Levels in Halibut with the EPA Guidelines for Unrestricted Consumption (16 meals per month) (chronic)

FIGURE 10
Mercury Levels in Halibut from Saint Paul Compared to Other Fish

FIGURE 11
PCBs Levels in Halibut from Saint Paul Compared to Other Fish

- 21 -
Discussion

halibut were about 10 pounds. Larger, older fish will have higher levels of mercury.

Polychlorinated biphenyls (PCBs) include a family of 209 industrial chemicals. A total of 65 were analyzed and summed in this study. The average level of PCBs in St. Paul Island halibut was 2 ppb. This is a very low level. This PCB level is comparable to PCBs in Alaska salmon and lower than PCBs detected in fish from the lower 48 and Canada.

CONTAMINANTS IN STORE FOODS

Are there contaminants in the foods you buy from the store? The answer is YES! All foods have different amounts of contaminants inside them. Although this report focuses on contaminants in halibut, it wouldn’t be complete without mentioning that common foods purchased from the store have contaminants as well.

In addition, foods from the store often have other chemicals added to them such as additives, preservatives, hormones and artificial sweeteners.

Barbara Lestenkof shopping at the store.

Did you ever wonder if there was more in your hot dog than what appears on the ingredient label? The June 2003 Total Diet Study analyzed beef hot dogs and detected the contaminants listed below. The contaminants were not in violation of food safety laws.

- Pesticides (6 pesticides in 36 samples)
- Other organic residues (21 residues in 36 samples)
- Cadmium (24 traces of cadmium found in 26 samples)
- Lead (5 traces in 26 samples)

Total Diet Study, sometimes referred to as the Market Basket Survey. The foods selected are believed to represent major components of the diet of the US population.

In this study, about 280 store foods have been tested for radionuclides, pesticides, industrial chemicals, and toxic and nutritional elements. Samples have generally been collected four times each year since 1982 from all over the country.

Although there is not complete contaminant data for all of the food we purchase from the store, the information from the Total Diet Study does demonstrate that contaminants are everywhere in our food. However, they are generally in small enough concentrations to not cause adverse health effects.

All foods have some level of various contaminants. The FDA Total Diet Survey shows that many foods have low levels of different contaminants. These low levels are considered safe for consumption. Because the levels of contaminants are so low, it is more important to make healthy dietary choices based on nutritional information. Comparing nutrient labels on different foods and choosing the healthier option is a great way to help make positive dietary choices.

If you are interested in learning more about the Total Diet Study, go to the website: www.cfsan.fda.gov/~comm/tds-hist.html
BENEFIT AND RISK ANALYSIS

Halibut is a highly nutritious food. It is low in salt, fat, and calories, and high in protein, omega-3 fatty acids, and selenium.

Halibut plays an important role in a healthy diet on St. Paul Island. Like other traditional foods eaten on St. Paul Island, halibut offers many nutritional benefits. The findings from a paper entitled “Nutritional Benefits of Subsistence Foods” written by Dr. Elizabeth Nobmann report that:

Subsistence foods make a substantial contribution to nutritional well being. Over half of the protein, iron, vitamin B-12 and omega-3 fatty acids in the diet of some Alaska Natives comes from subsistence foods.

Subsistence foods have nutritional benefits that make them preferable to many purchased foods. They are rich in many nutrients, low in fat, and contain more heart-healthy fats and less harmful fats than many non-Native foods (store-bought foods).

Alaska Natives eating subsistence foods have lower signs of diabetes and heart disease. The diet of Alaska Natives may explain their lower rates of certain kinds of cancer.

Eating and activity involved in gathering subsistence foods has positive benefits in avoiding obesity.

Halibut is rich in omega-3 fatty acids, sometimes referred to as the “healthy fats”. The omega-3s are reported to play a role in preventing diabetes and heart disease. St. Paul Island residents have a high prevalence of diabetes compared to the rest of the US, other Alaska Native groups, and when compared to Native Americans in general.

A shift from a traditional diet to a diet from the store may account for the increased prevalence of dietary related diseases on St. Paul Island. The diet of the Aleut people changed after WW2. People began to consume more foods from the store. Prior to the 1960s diabetes was rare among St. Paul Island residents, whereas today it is a problem. The 2003 St. Paul Island dietary survey reflects this change of diet in that 43% of the people surveyed reported eating less traditional foods today than 5 years ago.

Every time we make important decisions, we weigh the benefits and risks of taking the action. For example, when deciding whether or not to take a job, we might write a list of pros and cons. After making the list, we examine the pros and cons and make our decision. We do the same thing with our diet, whether consciously or subconsciously.

The choice of whether or not to consume halibut or any other food is very personal and must be your own decision. Having good information on benefits and risks helps you to make a more informed decision. The information on nutrients and contaminants in halibut provided in this report is the result of a well designed scientific study and can be used to better understand the benefits and risks of consuming halibut. However, there are other benefits and risks that are not considered in this report because they are based on personal values and lifestyle. Below are some questions to think about to better understand potential benefits and risks of consuming halibut. There are no right or wrong answers because these are personal questions.

Diabetes

Diabetes has become an epidemic in the United States. In Alaska, 3.4 percent of the population 18 and over are reported to have diabetes. Diabetes is a disease that effects all ages. It occurs when the body is unable to metabolize all of the blood sugar from the carbohydrates in the foods that we eat. Diet and exercise play an important part in preventing diabetes. People with diabetes are not able to produce enough insulin and/or use insulin properly that their body does produce. Without proper insulin levels in the blood, high sugar levels become harmful to all tissues. This can lead to serious medical problems including kidney damage, blood circulation problems that can lead to amputations, and blindness. Diabetes is also closely linked to heart disease. High blood sugar can be lowered by diet and exercise, by a number of oral medications or by insulin injections. Obesity is a main factor that has been shown to cause diabetes. Diabetes has increased among Alaska Natives over the past decade as a shift has occurred from a traditional lifestyle to a western lifestyle with accompanying increases in body weight, decreases in physical activity, and changes in diet. The prevalence of diabetes among Alaska Natives continues to increase at a higher rate than that of the United States as a whole.

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Discussion

BENEFIT AND RISK ANALYSIS, CONT’

CULTURE

• Should young people know how to harvest and prepare halibut? Do they?
• Does catching, preparing or eating halibut make me feel more connected to my culture?
• Do I share halibut with others or do others share halibut with me?

“In those days, we were healthy…nobody had major problems with health because everything in our diet was off the land… I remember my mom used plants as medicine… native foods are recommended by the doctors now…they are supposed to prevent the risk of cancer…. The majority of diabetics are being told to eat native food.”
(Vlass Shabolin)32

ENVIRONMENT

• How does my consumption of halibut or a replacement store food affect the environment?

PHYSICAL HEALTH

• Does halibut fishing, preparation, sharing, and cooking give me any exercise?
• Do I get exercise from getting and making store foods?
• Is it dangerous for me to get halibut?
• Do I choose healthy alternatives from the store if I don’t consume halibut?

“We have the highest percent ratio of diabetes per capita in the state of Alaska… hypertension, cholesterol problems, diabetes is what we see the most around here…”
(Jama Rukovishnikoff, Health Aide, St. Paul Island)

SPRITUAL

• Do I get any spiritual fulfillment catching, preparing or consuming halibut?
• How do I feel about eating halibut?

“When getting prepared for hunting…there’s a calm to it…a peace to it…you have to prepare…you have to know what’s around you…It’s definitely spiritual…it makes you one…it’s an understanding…
…If a child grows up learning about subsistence they are definitely rich in their life…if you know the land and respect it, you will definitely have a respect in yourself…”
(Gin Shabolin)33

ECONOMICS

• How much does a pound of halibut cost me, versus a pound of meat from the store?
• If I had a boat, would halibut cost me more or less than store meat?
• How do I get halibut? Are there other ways to get halibut? How much would it cost?
• What would I eat instead of halibut and how much would that cost me?

SOCIAL

• Is halibut an important food at social gatherings?
• Does catching preparing, or consuming halibut give me the opportunity to spend time with others?
• Am I too tired, busy, or have other reasons not to eat and/or prepare halibut?

“[Hunting]…it’s our time to get away… I see it as a constructive use of time…You have a friendship…a lot of joking around and talking…”
(Dustin Jones)34
CONCLUSION

The Aleut Community of St. Paul Island Tribal Government, in partnership with the Aleutian Pribilof Islands Association developed a process to evaluate the benefits and risks of consuming halibut on St. Paul.

The St. Paul Island Village Advisory Group directed the research process and interacted with a Technical Advisory Group through the Traditional Foods Program Coordinator on St. Paul.

Using the results of a local dietary survey and incorporating local interests and knowledge, The Village Advisory Group chose to test local halibut for nutrients and contaminants. The results of analysis showed that St. Paul halibut is a highly nutritious food and is low in contaminants.

When compared with commonly eaten foods from the store, St. Paul halibut is higher in protein and omega-3 fatty acids (the “good fats”) and lower in calories and saturated fats (the “bad fats”).

All contaminants detected in St. Paul Island halibut were low and not at a level of concern for human health. The strictest guidelines for consumption of halibut are for mercury and these guidelines are designed to protect the fetus of pregnant (or soon to be pregnant) women. These guidelines say that women of childbearing age can eat 2-6 pounds of halibut per week every week for a lifetime.

These risk assessment guidelines, however, do not consider the many benefits of consuming halibut and the protective function selenium is thought to play in counteracting the toxic effects of methylmercury.

The results of analysis were presented at a Traditional Foods Fair in April, 2004. This event was open to the entire community and included a presentation of findings, posters, dancing and a potluck.

In conclusion, there are many benefits to consuming halibut. The risks of contaminant exposure is low. This report helps identify some of the known benefits and risks of consuming halibut. Using this information, together with your personal values, can help you to make an informed decision on consuming halibut.

Aquilina Lestenkof participating in the production of the film Monitoring Contaminants in Rural Alaska.
What Can You Do?

• Get Involved! Participate in Research
  Measuring chemical contaminant levels in humans allows a determination of actual exposure levels of chemical contaminants in the diet. There are currently several ways to get involved in research:
  The Division of Public Health, Section of Epidemiology offers statewide hair testing for mercury for all pregnant women. The testing is confidential and free of charge. The results of this program will be important in developing future public health advice for fish consumption in Alaska. To participate in the Statewide Hair Mercury Biomonitoring Program and for more information on how to collect and submit hair samples, call the Section of Epidemiology, Environmental Public Health Program at 907-269-8000.
  The Alaska Native Tribal Health Consortium’s Maternal and Infant Monitoring Program offers pregnant moms blood testing for nutrients and contaminants. No additional needle prick is necessary as blood is taken during the first prenatal visit when blood is already being drawn. A sample of blood is also taken from the umbilical cord when the baby is born. Contact Martina Lauterbach, RN, for more information: 907-729-3680.

• Reduce pollution
  You can take simple steps to help prevent pollution in your community. Some ways to prevent pollution include: buying less packaged food, walk for transportation, reduce your use of hazardous materials, safely disposing of unused hazardous materials, not spilling gasoline, and not burning plastic and other materials that may produce toxic fumes. On a more global level, you can become involved in helping to prevent the manufacture and use of toxic chemicals internationally. Learn more about what persistent organic pollutants are and what actions need to take place to eliminate these chemicals. Check out this website for more information: http://www.ienearth.org/pops Threat-P1.html

• Eat Healthy
  Learn more about the traditional foods and store-bought foods you consume. Check out nutrient fact labels before purchasing food and compare labels. Also, be thoughtful about how you prepare your food. Adding extra salt, fat and sugar to food makes it less healthy.

• Make Healthy Choices
  Smoking cigarettes introduces contaminants into the body. Children are even more susceptible to cigarette smoke than adults. Make sure to keep smoke free areas for children.

• Check out these websites:
  Centre for Indigenous Peoples’ Nutrition and Environment: cine.mcgill.ca
  Arctic Monitoring and Assessment Program: http://www.amap.no/
  Northern Contaminants Program: http://www.ainc-inac.gc.ca/ncp/index_e.html
  Arctic Health: http://www.arctichealth.org/
  American Indian Health: http://americanindianhealth.nlm.nih.gov/
  Contaminants Found Me Curriculum Guides: www.contaminants.ca/about/pdfVersions/cfmBook2.pdf

CONTACTS: For more information on what you can do, contact APIA’s Aleut Traditional Foods Program at 907-276-2700.
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