SHELLFISH SAFETY

SHELLFISH SAFETY RESOURCE MANUAL

Acknowledgements

Penelakut, Cowichan Tribes and Chemainus Fisheries Staff and the Hul'qumi'num Treaty Group would like to thank Health Canada for financial assistance in creating this manual. Technical input was provided by various federal agencies both through staff members and websites.

Thanks to Kristiann Allen for her original illustrations some of which were drawn for the companion colouring book and have been reproduced in this manual.

A Penelakut, Chemainus, Cowichan Tribes and
Hul'qumi'num Treaty Group Project

Revised 2007. Originally produced in 2005 as part of a joint Penelakut and Chemainus Fisheries Project

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Foreword

This manual was originally developed in response to community concerns that access to marine resources is dwindling while regulation and management of resources are getting more complex. This manual was revised and expanded in 2007 to include additional information on heavy metals in shellfish as well as new education outreach resources.

Many communities have a long history of using shellfish resources and have traditional knowledge of safe harvesting practices. Unfortunately, some human activities can lower the quality of shellfish or make it unsafe to eat.

This manual is intended to provide explanations and educational material to help technical staff educate community members on regulations and safe practices.

There are 3 main sections to the manual:

Contaminants – Information on contaminants common to British Columbia and their associated health risks.

Benefits – Highlights the health benefits of eating shellfish.

Risk Management – Ways to minimize the risk of eating or becoming ill from eating contaminated shellfish.

How to Use this Manual

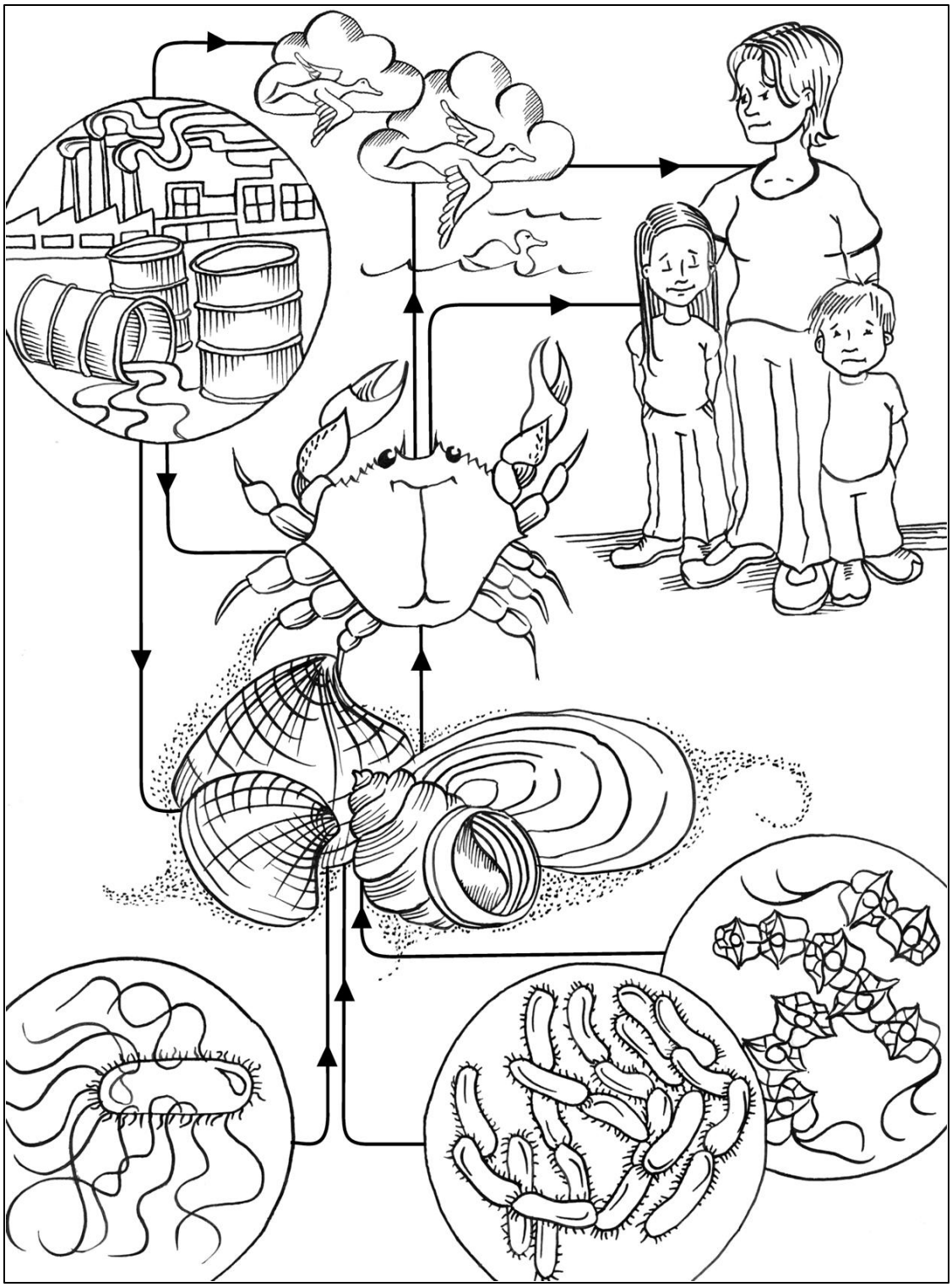
This manual is intended to support Fisheries and Resource Management staff in educating community members on safe shellfish harvesting. Clams, oysters, cockles, and crabs are traditional foods that are important for a healthy diet.

The material is presented in two ways. Information intended for **technical staff** is presented in two columns separated by a green line. Outside that line, technical terms are highlighted, and on most pages there is room for you to make notes. There is a glossary at the back of the manual with more detailed explanations of key terms.

Education tools for **community members** are presented in a full-page format for sharing. They can be photocopied as handouts or inserted in newsletters. This information is also available on the included CD.

In addition to this manual, other ready made educational materials have been created, including posters, activities for teachers/ technical/fisheries staff and a colouring book for teaching elementary school children about PSP in shellfish.

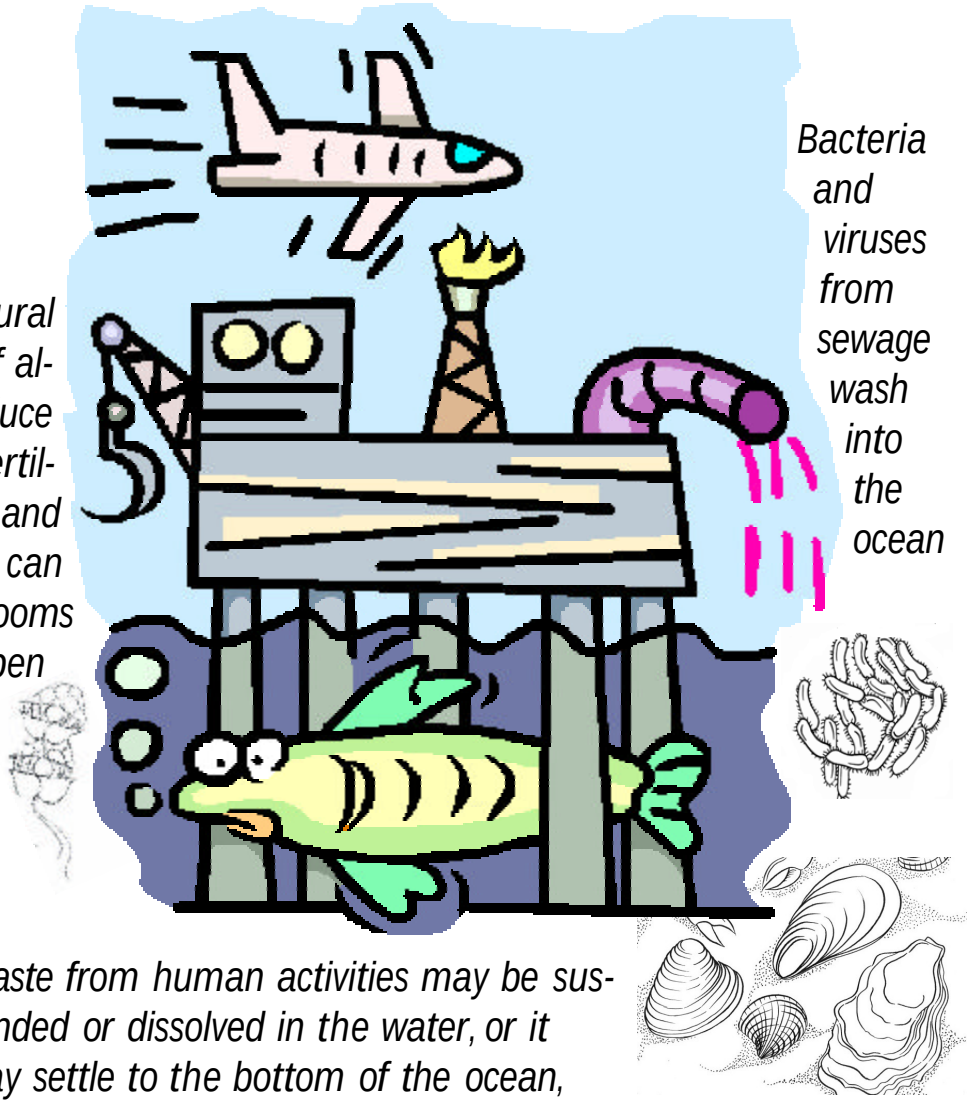
CONTAMINANTS



How Do Contaminants get in Shellfish?

Human activities like farming, travel, industry and daily living affect our environment. What we do on land affects the ocean too.

Natural blooms of algae produce toxins. Fertilizers and manure can make blooms happen more often.



Bacteria and viruses from sewage wash into the ocean

Waste from human activities may be suspended or dissolved in the water, or it may settle to the bottom of the ocean, where sea animals come into contact with it.

Sources of Contamination

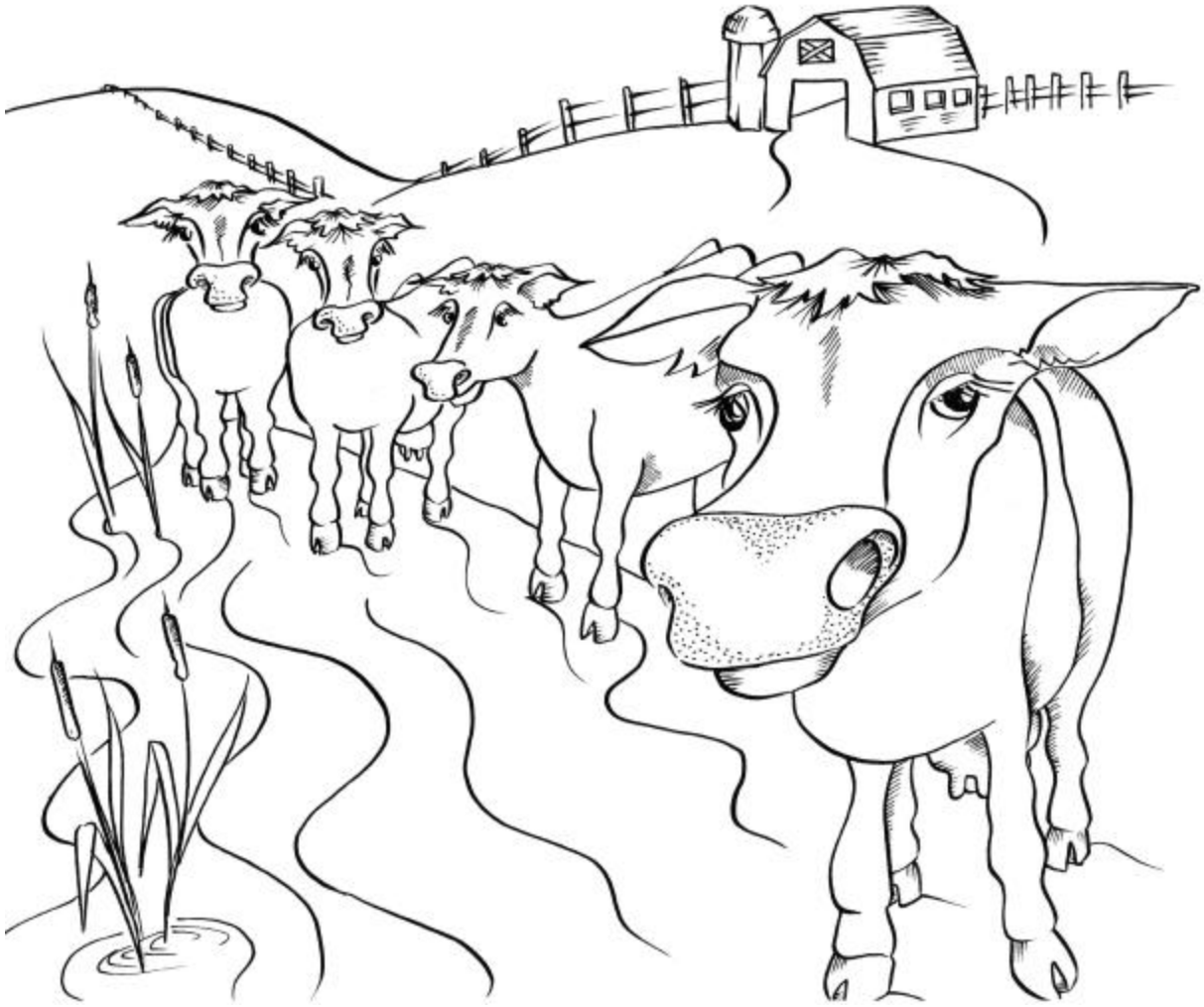
Shellfish contaminants are substances that lower the quality of shellfish or make them unsafe to eat.

There are several types of contamination in BC shellfish that can be of concern. Contaminants come from a variety of sources, both natural and man-made. The most common sources are Red Tides, sewage, and pollution from industrial activities.

Even natural sources can be affected by human activities. Farming, lawn care, and industrial activities add nitrogen, cadmium and other chemicals to the ocean,

Natural Sources

- Harmful Algae Blooms: Illnesses like Paralytic Shellfish Poisoning (PSP) ,and Amnesiac Shellfish Poisoning (ASP) come from plants that live in the ocean.
- Bacteria: Some bacteria, like Vibrio species, occur naturally in the marine environment. When high amounts are present in shellfish eaten by people, they can cause illness.
- Heavy metals: Cadmium, Lead , Nickel, Chromium, and Arsenic are all naturally present in the sediments of the ocean bottom and also



Agricultural Activities

can add fertilizers, pesticides, fecal coliform bacteria and other contaminants to the marine environment through run-off into streams which eventually flow into the ocean.

in the water column. The levels of these metals in the ocean can be increased by inputs from industrial activities.

Man-made Sources

- Heavy Metals: Metals can be added to the environment as waste products, by-products from manufacturing processes, or through emissions from vehicles and factories.
- Sewage: Bacteria and viruses associated with human body and animal waste (managed by counting fecal coliform bacteria) can enter the ocean through un-treated or under-treated sewage. Failed septic systems are a significant source of untreated sewage, Farm practices can result in large volumes bacteria from manure entering the ocean via runoff and streams.
- Industrial waste: Pesticides from agriculture and insect control programs and industrial processes (dioxins, furans, PCBs)

Fecal coliform bacteria –Tiny animals that normally live in the guts of mammals. They are measured to show if sewage is likely present.

Do you know the symptoms of Paralytic Shellfish Poisoning?

If you feel tingling and numbness in your lips and tongue after eating shellfish, you should immediately go to the hospital.

Before you dig, talk to the Resource or Fisheries Officers about what and where you can harvest safely.

Red Tide

Red Tide, or Harmful Algal Blooms (HABs), happen when tiny marine plants that live suspended in the water (algae) suddenly start to reproduce and multiply. Algae blooms are normal and usually occur when the ocean and weather conditions encourage algae to grow. Warm summer temperatures, lots of sunlight, and nutrients in the water are the key ingredients.

If the algae that are blooming make a material inside their cells that can harm people or animals, it is called a harmful bloom. It used to be that people thought it was safe to harvest during months that end in "R". This is not true! Blooms can happen any time.

HAB-Harmful Algae Bloom. Rapid growth and abundance of algae that may have negative health impacts.

Algae –Tiny plants that live in the water. They are the main source of food for most shellfish.

PSP

Paralytic Shellfish Poisoning (PSP) is an illness that is caused by a poison or toxin that is made inside

Genus—A formal name for a group of animals (species) that are closely related, but do not reproduce together.

Saxitoxins –a group of chemicals produced by some types of algae. The chemicals are harmful to humans.

Siphon –The part of clams and cockles that extends beyond the shell. Used to bring oxygen and food into the shellfish. (neck or nose)

Gonads - A name for both the male and female sex organs.

a group or genus of algae called *Alexandrium*. The group of toxins produced by species of *Alexandrium* is called saxitoxins. These algae do not always produce toxins and there is no way to predict when conditions will cause it.

Shellfish (clams, mussels, oysters, scallops) eat algae as their food, and toxins in the algae build up in their bodies. The toxins do not usually harm the shellfish and when they are harvested they look healthy and normal. When animals or humans eat the shellfish they can become very ill and in some cases die.

Some species of shellfish do not easily release toxins that have built up in their bodies while eating algae. Butter clams (*Saxidomus giganteus*) can hold saxitoxins for over a year in the neck (siphon) and gills. Scallops also hold toxins in their bodies for long periods of time. The area of highest build up is in the roe (gonads) which should be removed and thrown out before the meat is eaten.

Health Risks

The symptoms of PSP usually start with numbness or tingling in the lips within 5 to 30 minutes after eating shellfish contaminated with saxitoxins. The numbness will spread to the face, neck, fingers and toes. Some people experience dizziness and headache. As the numbness (paralysis) continues, it causes weakness in the arms and legs and interferes with the person's ability to breathe. Respiratory arrest and death can occur very quickly.

Treatment

If anyone suspects that they have eaten shellfish contaminated with Saxitoxin, they should induce vomiting and IMMEDIATELY go to a HOSPITAL and tell a medical professional that they suspect Paralytic Shellfish Poisoning.

Stay Healthy Eating Shellfish

Paralytic Shellfish Poisoning, Salmonella, Vibrio, Norwalk-like virus and Hepatitis are some of the dangers in our waters.

Know the Risks: Talk to Fisheries or Resource Officers about safe shellfish harvesting.

ASP

Like PSP, Amnesiac Shellfish Poisoning (ASP) is caused by eating shellfish that have toxin in their bodies. In this case, the toxin is called Domoic Acid and is produced by algae of the genus *Pseudonitzschia*. Blooms of *Pseudonitzschia* do not happen every year and so ASP is much less common than PSP. In high amounts, ASP can sometimes harm the shellfish that eat it.

Domoic Acid -A toxic chemical that is sometimes produced by algae. It causes Amnesiac Shellfish Poisoning.

Health Risks

Symptoms of ASP are severe nausea and diarrhea within 30 minutes to 6 hours after eating contaminated shellfish. Most people recover completely within a few days, but should still seek medical help. People who suffer from other illnesses (kidney problems, for example), babies, and Elders, can be more seriously affected. ASP can cause temporary or permanent brain damage and affects short term memory. Severe cases can result in death.

*If contaminated shellfish may be the cause of illness, the affected person should always **seek medical help**.*

Treatment

There is no known treatment for ASP.

Bacteria and Viruses

Not all bacteria and viruses present in the ocean cause illness. Fecal coliform bacteria do not cause illness, but they are associated with human sewage and so are used to measure water quality. Illnesses caused by bacteria and viruses can be spread through human body waste in sewage. High levels of fecal coliform bacteria are an indication that human body waste is contaminating the water. It is also an indication that other bacteria and viruses that do cause illness (pathogens) are also present.

Pathogen -Any substance, particularly bacteria or viruses that causes disease.

The following are the most common pathogens in shellfish:

Salmonella – These bacteria are a common cause of diarrhea in humans. Symptoms usually start within 12 hours of eating contaminated food and may last for several days. The illness is not usually fatal, but babies and Elders may be more seriously affected. Salmonella can be spread if the contaminated food comes into contact with counters, cloths, and other food!

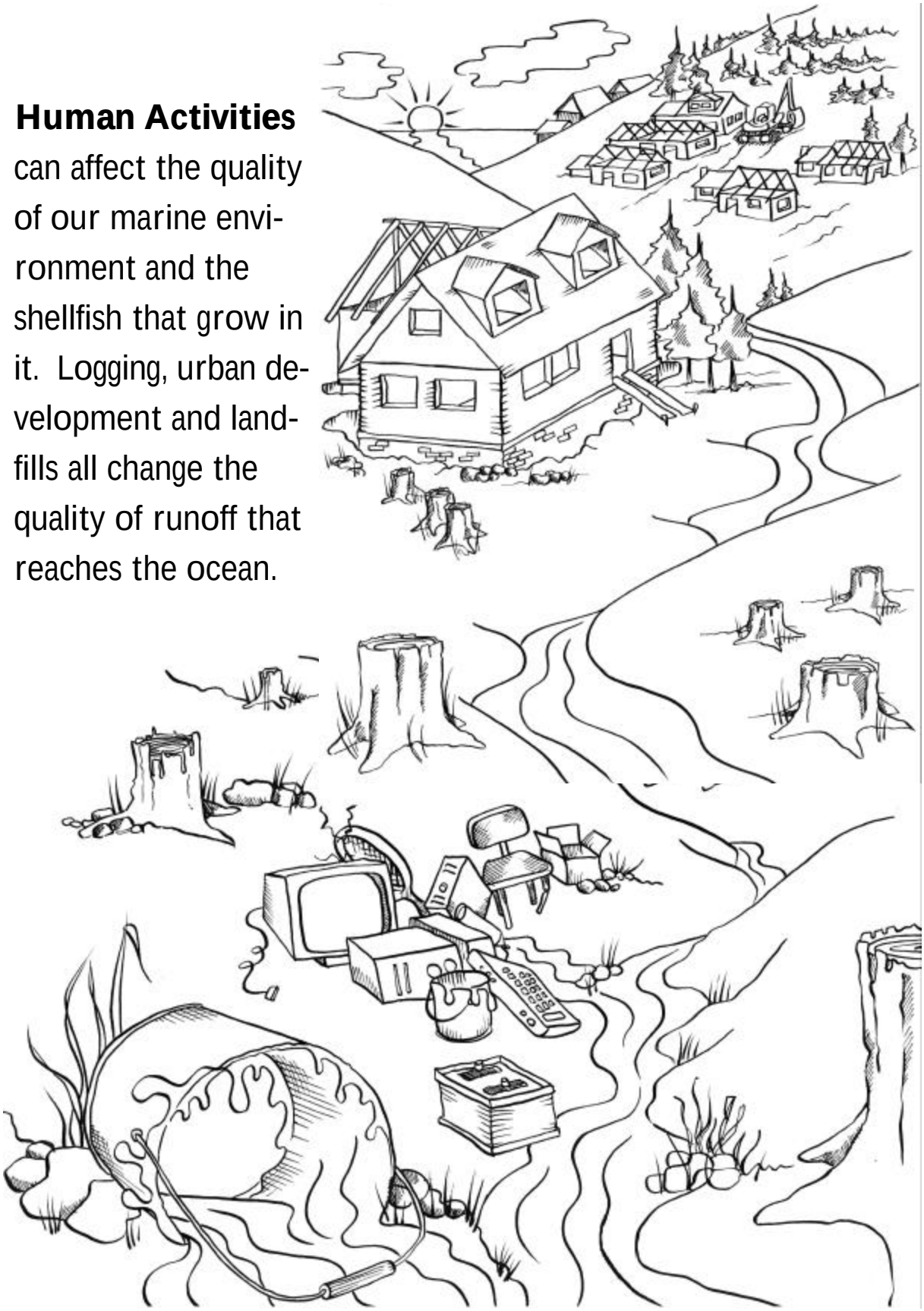
Vibrio – Symptoms are nausea, weakness, chills, cramps, diarrhea and vomiting that lasts 1 to 8 days. Dehydration is common and can cause shock and even death. It is usually contracted by eating raw or undercooked oysters and other shellfish.

Vibrio– In 1997, over 200 people got sick from eating raw oysters from West Coast growing waters; one person died.

Hepatitis A – A viral illness that affects the liver, symptoms start a month after exposure to the virus. Symptoms include: fever, stomach upset and generally feeling tired and unwell. A few days later jaundice (yellow skin) develops. Most people recover completely, but the illness can last for months.

Norwalk-type viruses – Symptoms begin the same day of eating contaminated shellfish and include nausea, diarrhea, vomiting, cramps, headache and fever. The illness usually lasts 1 to 2 days.

Human Activities can affect the quality of our marine environment and the shellfish that grow in it. Logging, urban development and landfills all change the quality of runoff that reaches the ocean.



Heavy Metals

Cadmium, Lead , Nickel, Chromium, and Arsenic, although naturally occurring in the environment, are not usually present in high concentrations in ocean sediments unless they are introduced by human activities. Many natural and consumer products contain small concentrations of different heavy metals. For example, you can find cadmium in vegetables, batteries and computers: lead in gasoline and paint; nickel in coins, kitchen utensils and milk; chromium in fresh foods and copy machine toner; and arsenic is used in pesticides, herbicides, insecticides and metal alloys.

Metals are mainly deposited in the ocean through runoff, when leachates from landfills and industrial waste are taken up by rainfall and washed into streams, rivers, and eventually the ocean.

Because oysters and clams filter heavy metals from the water that they pump through themselves, they can actually accumulate enough of these elements to become toxic to humans.

Health Risks

In Hul'qumi'num territory surveyed for this report, cadmium levels are lower than elsewhere. Hul'qumi'num adults can enjoy up to 4 cups of oysters every month without long term risk.

Consumption of low levels of some heavy metals, like lead can have serious effects on mental development in children and cause permanent damage to the nervous system. Other heavy metals like cadmium are more likely to cause kidney damage after many years of regular exposure. In BC waters, oysters contain cadmium in high levels. **Health Canada advises adults to limit consumption to 2 cups (480g) a month.** Health Canada advises that children should eat only 1 oyster a month. Nickel is not toxic in the low levels usually found in shellfish. Chromium is rarely found in high levels in BC waters, but long-term exposure can cause kidney, liver, circulatory, and nerve damage. The form of arsenic usually found in the marine environment can cause stomach upset or nerve damage.

Organochlorine - The family of chemicals that are made mainly of carbon & hydrogen atoms and have at least one chlorine atom

Bioaccumulation - The build up of a substance (like a toxin) in the tissues of a living plant or animal.

POPs

Persistent organic pollutants (POPs) are chemicals (dioxins, furans, organochlorine pesticides, PCBs) that enter the food chain through human activities. They are called 'persistent' because, unlike many other contaminants, they do not fade away over

time and cannot be diluted. Instead the amount in people increases as we are exposed to POPs over time (bioaccumulation).

In the 1990s international concern over the potential effects of POPs on human health resulted in a call for global action on the 12 substances believed to hold the greatest threat to human health. These 12 substances, known as the dirty dozen include: 8 organo-chlorine pesticides, 2 industrial chemicals (including PCBs), dioxins, and furans.

In 2004, an international treaty on POPs known as the Stockholm Convention required participants to outllaw nine of the chemicals and work to reduce the production of dioxins and furans. However, POPs remain in the food chain and in the sediments. POPs can be passed on through eating contaminated food and from mothers to babies via the umbilical cord and breast milk.

Consumption limits– Recommendations from Health Canada about how much of a certain food it is safe to eat.

Health Risks

The health effects of POPs in humans are long term and not well understood. They affect reproductive organs and the nervous system. Some have been linked to cancers. Exposure to POPs through

diet is managed by consumption limits for species that are known to be affected in a specific area.

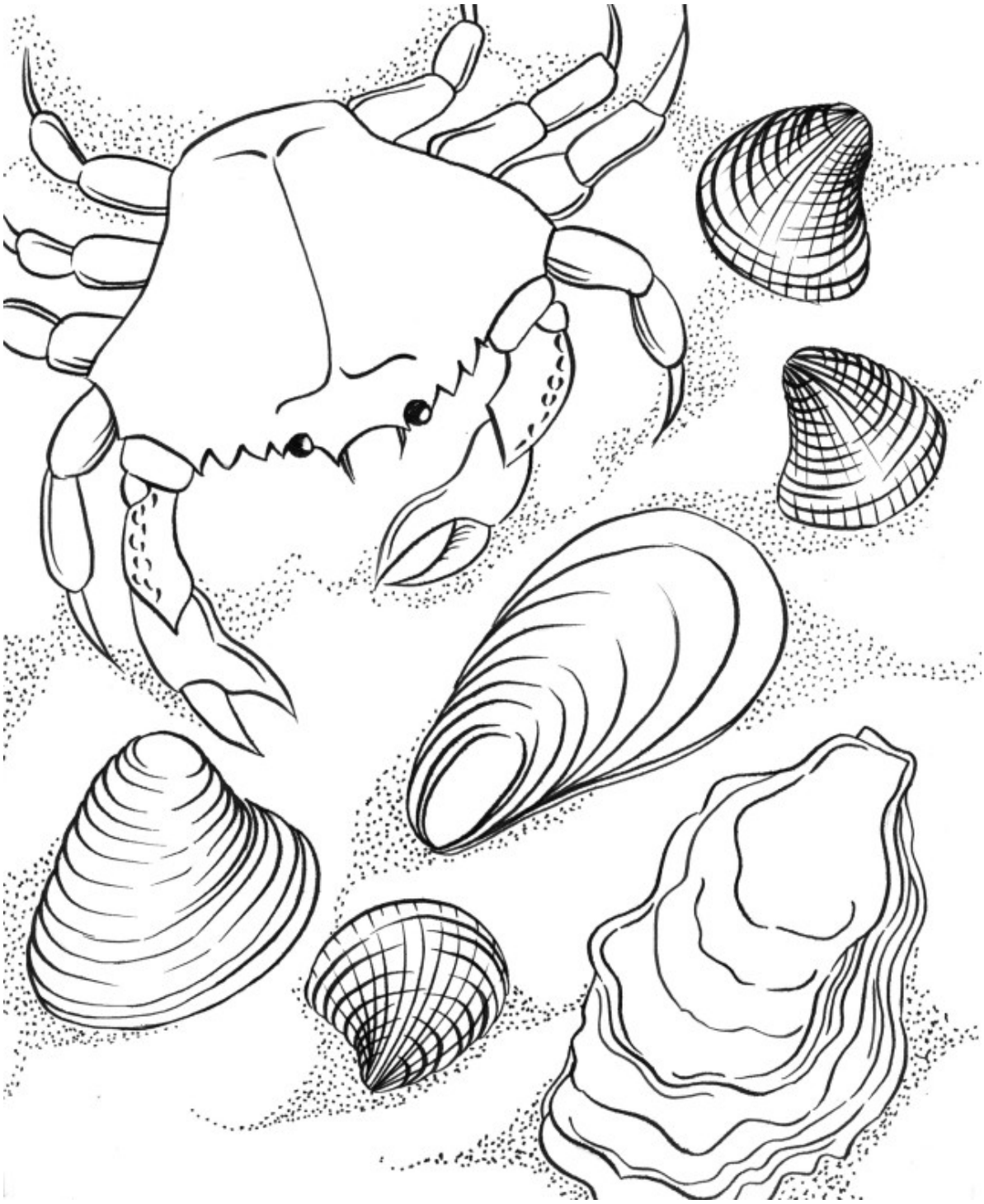
PAHs

Polycyclic aromatic hydrocarbons (PAHs) are a large group of similar chemicals that are primarily formed during the combustion of carbon containing fuels such as wood, coal, and diesel. They also may be found in crude oil. PAHs are considered to be one of the most widespread organic pollutants, but unlike POPs, they are generally broken down in the environment in a matter of weeks to months. Many of these chemicals enter the environment from vehicle exhaust, smoke from woodstoves and furnaces, and exhaust from coal burning electrical generation; eventually settling in soils and sediments

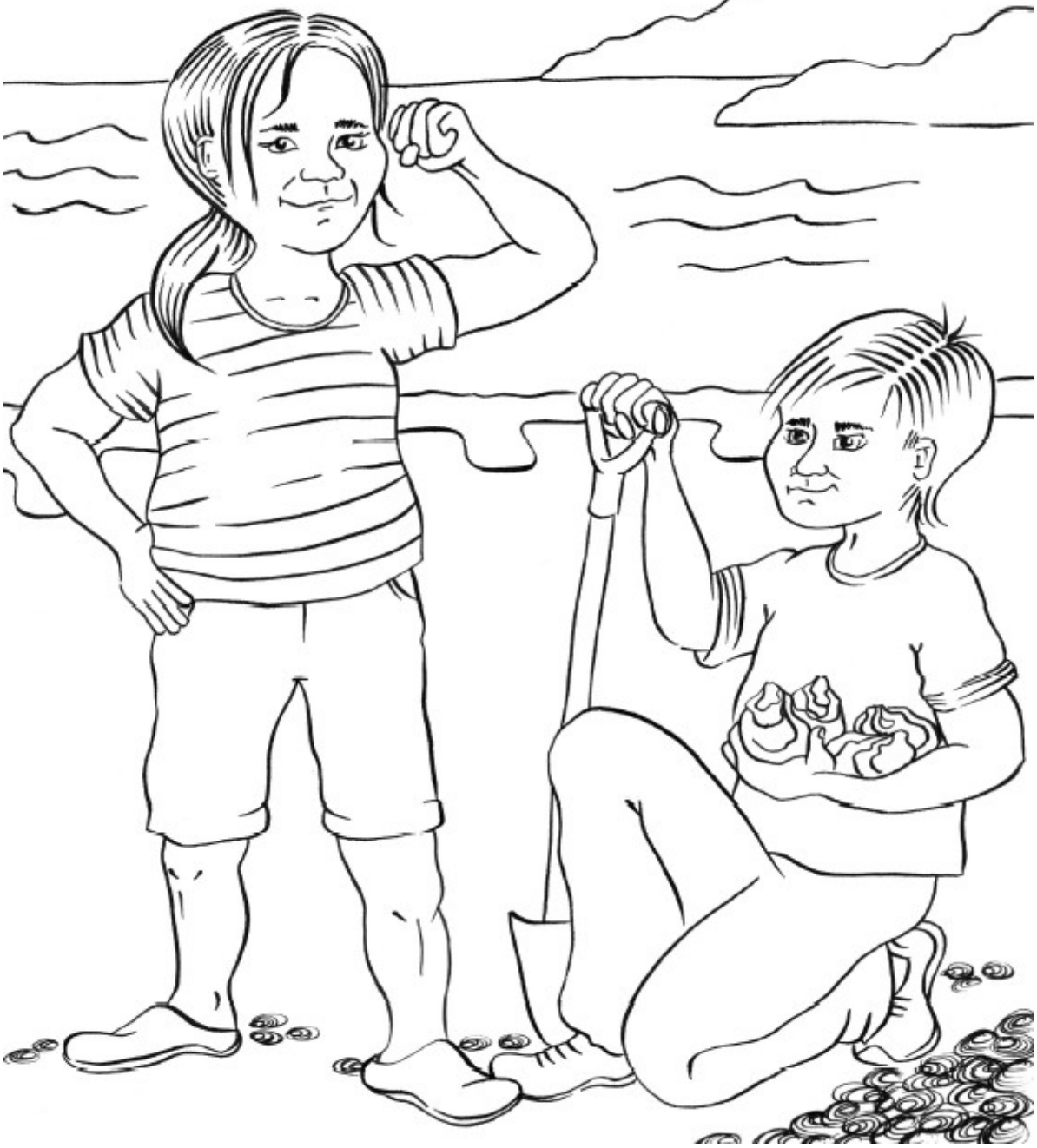
Health Risks

The health effects of PAHs vary widely, with many showing little or no toxicity and others being extremely toxic. In general, exposure to high concentrations of some PAHs has been linked to cancer and some have been shown to cause birth defects in animals.

BENEFITS OF SHELLFISH



Shellfish help keep your muscles and blood strong.



To stay strong, eat protein rich foods like shellfish, eggs, fish, meat, birds, nuts and beans 2 or 3 times a day.

A serving is 2.5 oz (75 g) or about half a cup. For shellfish this is about 6 oysters or clams or 12 mussels.

Why eat shellfish?

There are many benefits associated with eating shellfish. Harvesting and eating shellfish can:

1) Harvesting can be a fun activity

Kids spend a lot of time indoors both at school and at home. It's fun to hang out on the beach and it's the best place for kids to learn about our history of harvesting shellfish.

2) Improve your health and save money

Before there were grocery stores and imported food, Coast Salish adults ate over 2 lbs (1kg) of meat and seafood daily. Today, less than half of First Nation adults (Aboriginal People's Survey, 1991) say they eat meat, fish, or chicken every day (meat and alternatives food group). One out of 10 report they only eat meat once a week.

Food group – Nutritionists commonly group food into 4 different groups. Foods *containing similar nutrients are grouped together.*

For good health, people need about 2-3 servings a day of protein rich foods in the meat and alternatives group. A serving is 2-3 oz (60-90 g) or about 1/2 a cup.

These days, community members' diets can be poor in protein and vitamins and minerals like vitamins A, D, folate, iron, calcium and zinc and rich in fat and sugar (from foods like juice and pop, candy, potato chips, French fries, fried foods). These foods may be filling and taste good but they are not nourishing in a balanced way; instead they contribute to common health problems in many communities: *cavities, anemia, obesity, diabetes and heart disease.*

Anemia –An illness when the level of red blood cells is lower than normal

Adding a meal of shellfish to a family's diet on a regular basis could significantly improve the health of families. Shellfish are rich in **iron** and **protein** and **low** in fat (when not fried)**.** It could also keep extra money in families pockets. Foods from the meat and alternatives group are often the most expensive items in the grocery store.

3) Prevent Iron Deficiency Anemia

Iron Deficiency Anemia is a hidden health problem because it can take several months to develop and there are usually no early symptoms.

Iron deficiency anemia happens if people do not eat enough iron rich foods everyday.

Iron deficiency anemia means that there is not enough iron in the blood to make new blood cells and carry oxygen from our lungs to the rest of the body.

Symptoms include: fatigue, headaches, difficulty sleeping, chest pain, dizziness, difficulty breathing and rapid heartbeat upon physical exertion.

Pregnant women with iron deficiency anemia are more likely to have **premature babies** with **health problems**.

Most adults and children can meet their daily iron needs by eating 6 clams or oysters or 12 mussels. Females of child-bearing years need 3 to 4 times as much iron as male adults, Elders, and children.

It's important to include iron rich foods in one's diet on a daily basis. Most adults and children can meet most of their iron needs by eating a variety of iron enriched foods and including foods from the meat and alternatives group. Females of child-bearing years have higher nutrient requirements: iron needs are 2.5-4 times greater than an adult male.

*Shellfish are rich in **iron** and **protein** and **low** in fat (when not fried)**.***

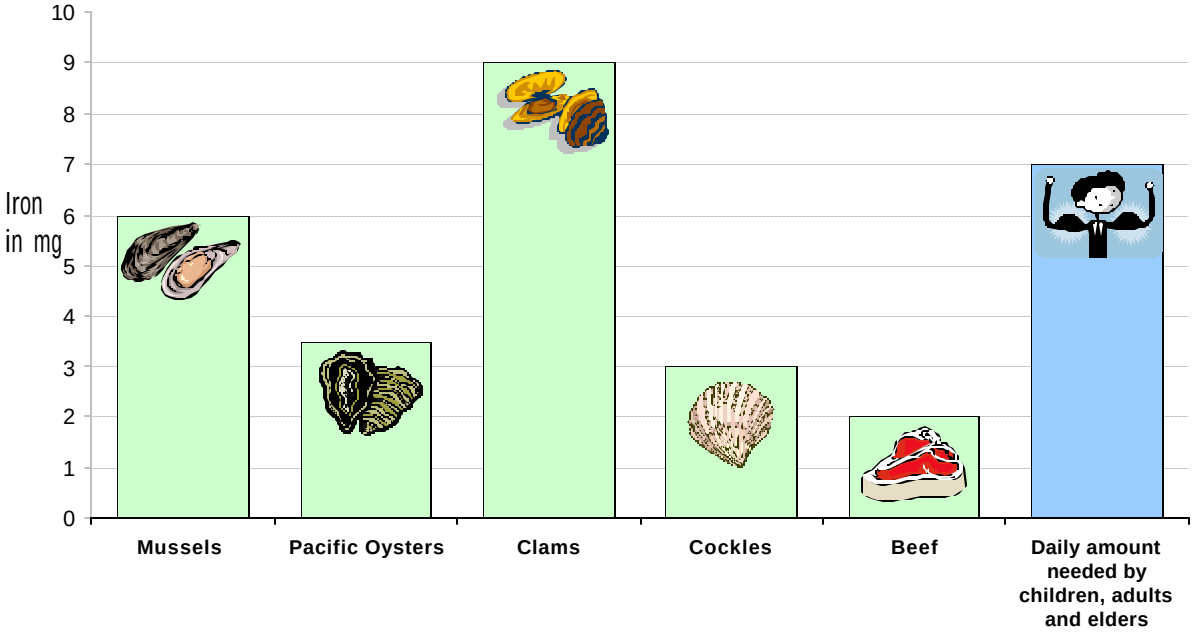
Shellfish: Rich in IRON

IRON is needed for strong and healthy blood. Blood carries oxygen to our brain, muscles and organs.

If you are not getting enough iron, you might:

feel dizzy
feel like your head's in the fog
feel tired all the time no matter how much you rest
become cranky
get out of breath when you climb or walk fast
have trouble sleeping
get headaches

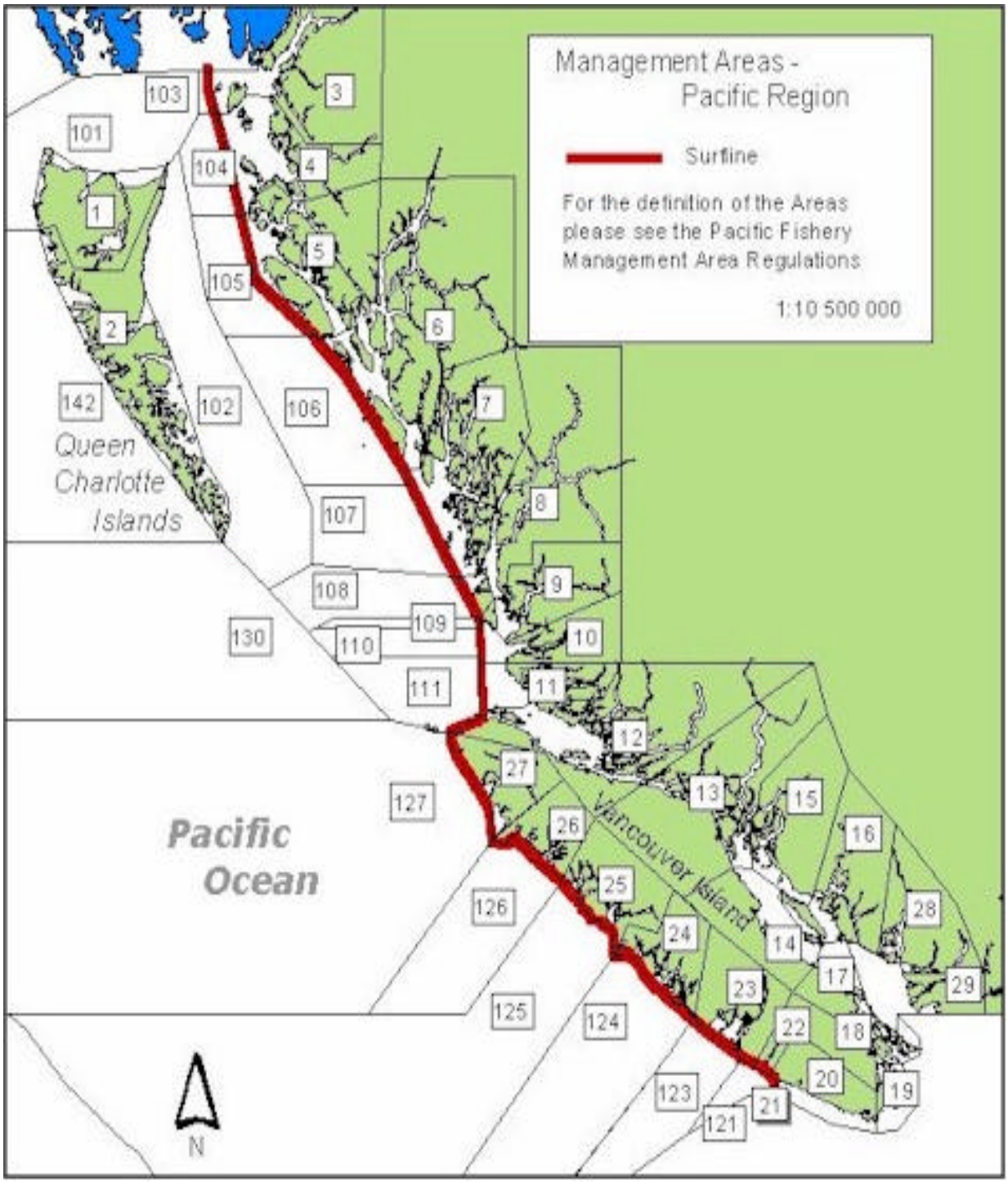
Check out how much iron you can find in 1/2 cup of these foods. The blue box shows how much iron most people need everyday. Women in childbearing years need more.



RISK MANAGEMENT

DFO Fisheries Management Areas

http://www.pac.dfo-mpo.gc.ca/ops/fm/Areas/areamap_e.htm



Risk Management

There is always some risk that a person eating any food will become ill. What government agencies try to do is reduce that risk by creating and enforcing guidelines that control how food is grown, harvested, processed and handled.

Risk Management – Balancing the risk of contaminated shellfish with the benefits of eating healthy, traditional foods.

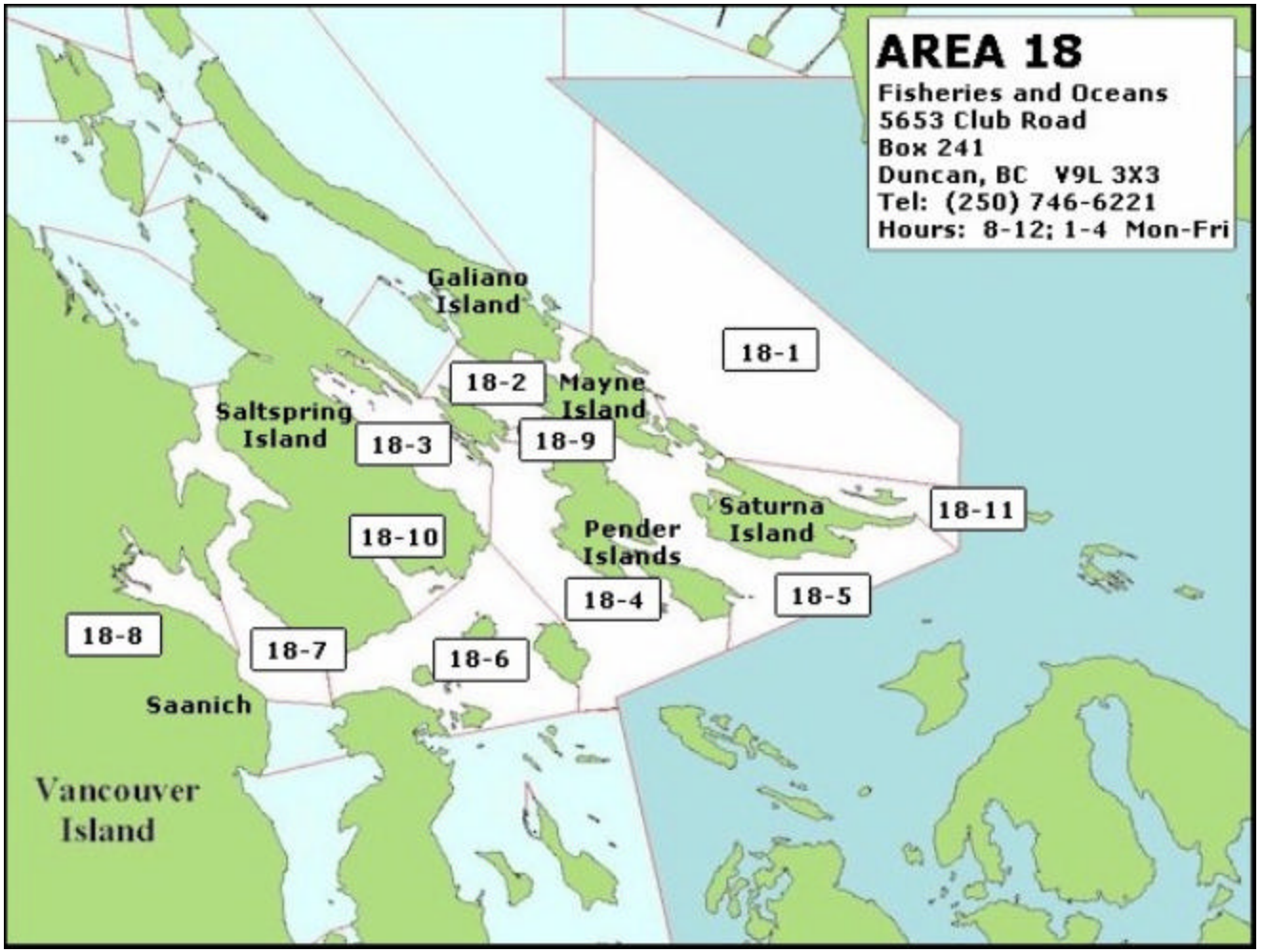
Red Tide **closures**, sanitary closures, **consumption limits**, **cooking** and **safe food preparation** are all ways to *manage* the risks associated with eating contaminated shellfish. Much research has been done to determine what levels of each contaminant will cause harm to people and what conditions (weather, temperature, past and present land use, etc.) are likely to make matters better or worse.

No one can ever say with perfect certainty that a specific food is 100% safe to eat. What we can say is that it is very unlikely that you will become ill if food is properly harvested and handled.

Federal government agencies manage marine resources by dividing the coast and waters of the province into *management areas*. There are 48 management areas for BC, shown on the map on

DFO Fisheries Management Area 18

http://www.pac.dfo-mpo.gc.ca/ops/fm/Areas/area_18_e.htm



page 31. Each management area is numbered and a written description of its boundaries can be found in the Pacific Fishery Management Area regulations:

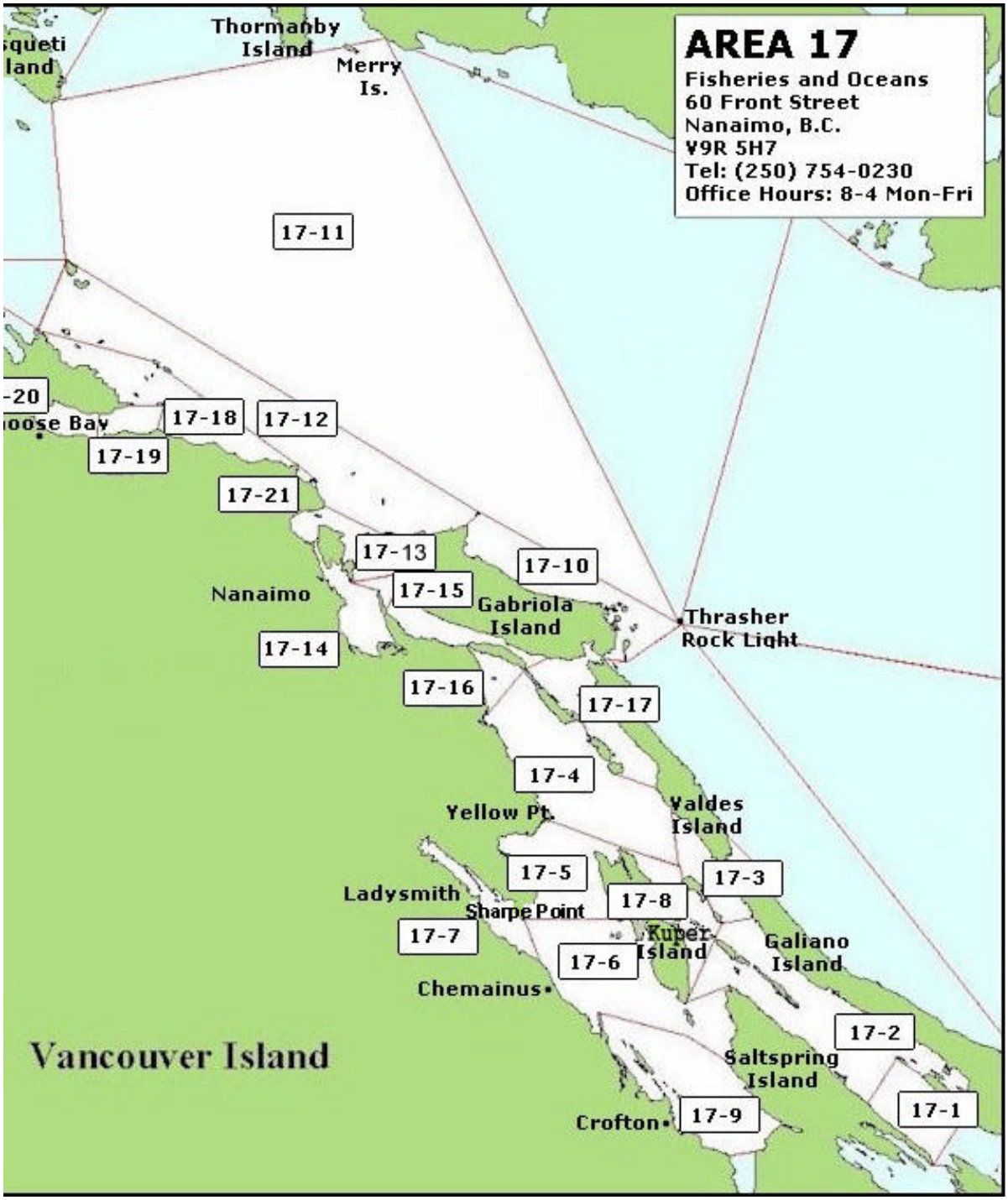
http://laws.justice.gc.ca/en/F-14/SOR-82-215/index.html

Each area is further divided into *sub-areas*. Sub areas are identified by the area number followed by a dash and another number. For example, Area 18 has eight sub-areas: 18-1 through 18-8. On an Area map, the sub-area labels are usually highlighted in a white text box.

Shellfish closures notices issued by Fisheries and Oceans Canada, identify the regions affected by area / sub area.

DFO Fisheries Management Area 17

http://www.pac.dfo-mpo.gc.ca/ops/fm/Areas/area_17_e.htm



Shellfish Closures

Shellfish Closures are notices from government agencies that commercial harvesters and members of the public (recreational harvesters, tourists, First Nations) should not harvest shellfish in a specific area.

The agencies involved in these decisions are mainly the Canadian Food Inspection Agency (CFIA), Environment Canada (EC), and Fisheries and Oceans Canada (DFO). These agencies may also publish recommendations that people limit the amount or how often they eat certain species (consumption limits). These limits may be specific to a certain area or may be general recommendations.

There are two main types of shellfish closures:

- Biotoxin closures - used to manage human health risks associated with PSP and ASP
- Sanitary Closures - used to manage human health risks associated with fecal coliform bacteria.

CFIA - Canadian Food Inspection Agency. CFIA is responsible for monitoring, reporting and enforcing food safety.

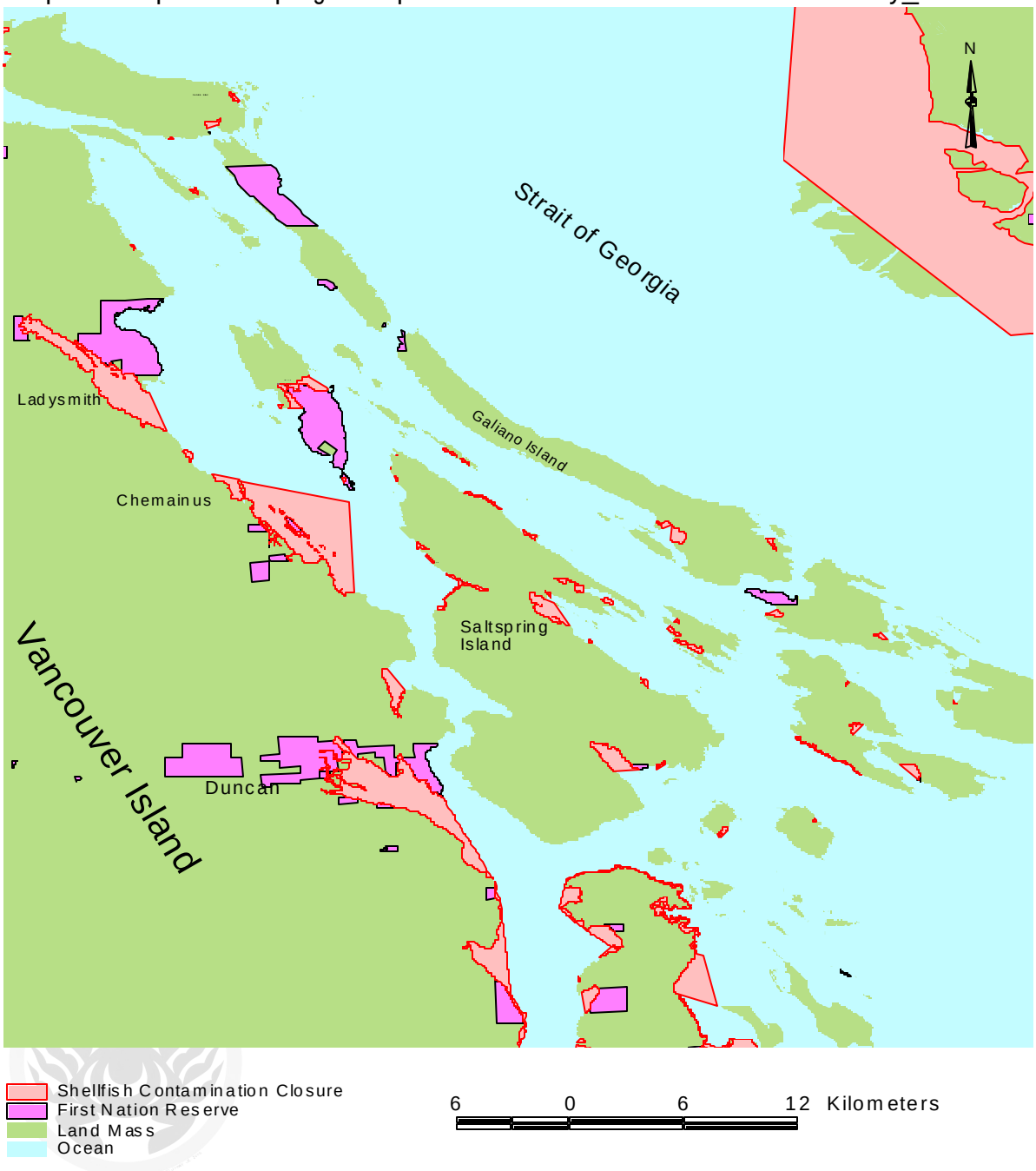
EC -Environment Canada. EC monitors shellfish growing water quality.

DFO -announces and enforces shellfish closures.

Shellfish Sanitary Closures -Southern Gulf Islands

The red / hatched areas below are closed to shellfish harvesting because of high levels of the bacteria found in sewage.

For current closure information go to:
http://www.pac.dfo-mpo.gc.ca/ops/fm/shellfish/Biotoxins/closures/sanitary_e.htm



Reading a closure map

Biotoxin closures are identified in Fishery Notices issued by Fisheries and Oceans Canada. The affected areas are identified by management area or sub-area. For example:

> Area 19
>
> Subareas 19-7 to 19-12 closed to scallops and butter clams only;
>
> Balance of Area 19 closed to all bivalve shellfish.

Shellfish growing waters are classified based on the results of testing for fecal coliform bacteria. The sampling is scheduled to try to capture the times when contamination is likely to be the worst. By classifying areas based on the worst level, EC hopes to minimize the likelihood of people harvesting contaminated shellfish. The classification categories are: **approved, conditionally approved, closed, and prohibited**.

Sanitary closures are identified differently than biotoxin closures. As each area is classified it is given a unique number. For example, the first sanitary closure in area 17 would be identified as closure 17.1, the fifth closure would be 17.5. These labels look similar to sub-area identification numbers and should not be confused with them.

Science is Cool

Monitoring and Testing

PSP is monitored by CFIA throughout BC. California (surf) mussels are harvested from the east coast of Vancouver Island and distributed around the province. The mussels are hung in the water at sampling stations and regularly harvested and shipped to an approved lab for testing.

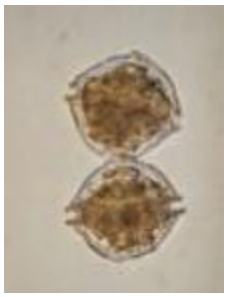
In the winter months (October-March) the mussels are tested every two weeks. In the summer, the likelihood of a bloom of *Alexandrium* algae increases and the mussels are sampled every week.

The test performed is called a mouse bioassay. Specific mice that are genetically similar are used to carry out the test. Extracts of liquid from the meat of the mussel containing purified saxitoxin are injected into the mice and the level of harmful effects (toxicity) is measured. One reason for limiting the number of sampling stations for PSP is that only so many of these mice are available.

PSP

PSP is considered a danger to humans when the level of saxitoxin is higher than 80µg/100g of shellfish meat.

Alexandrium species



Mouse bioassay - A test to discover the strength of a substance by comparing its effects on a specific strain of mouse.

µg-(microgram) A measure of mass that is 1/1000th of a gram.

ASP

ASP is tested at the same time as PSP, using a different method involving chemical analysis of the liquid extract from the PSP test. If any cause for concern is identified through this first test, a second more precise test is carried out.

Shellfish testing higher than 20µg of domoic acid/100 g of shellfish meat is considered a risk for ASP.

Water Quality

Sanitary closures-Notices that forbid shellfish harvesting on beaches with high bacteria counts.

Water quality sampling takes place on a 3 year cycle throughout the province. Specific areas may have modified sampling schedules. Each site is sampled once a day for 5 days. Once the results have been obtained the sites are classified: approved, closed, conditionally approved, or prohibited

Conditionally approved areas may have seasonal closures or be temporarily closed after heavy rains or during times of high use by recreational boaters. Some harvesting in closed areas is possible using depuration protocols.

Depuration

Depuration - Removal of contaminants, especially fecal coliform bacteria.

Depuration is a process where bivalves are cleaned of fecal coliform contamination by allowing them to naturally flush it from their systems. In a depuration facility (processing plant) contaminated shellfish are tested for bacteria levels and then placed in filtered, sterilized seawater for 48 hours. After 48 hours the bacteria levels are checked. Relaying is a process by which shellfish on beaches, are moved from contaminated areas and placed on uncontaminated or clean beaches. After a minimum of 2 weeks, they are tested. If the samples tested in either method meet CFIA guidelines then they are approved for sale

In **prohibited** areas, shellfish harvesting is not permitted. Bacteria levels are considered too high to be cleaned by depuration, or there is contamination from other pollutants that are not removed by depuration.

Prevent Illness from Shellfish

Salmonella, Vibrio, Norwalk like virus and hepatitis are some of the harmful pathogens entering shellfish growing waters from human and animal sewage.

Practice safe storage, handling and cooking to prevent illness.

1. Keep live shellfish cool (at 4ºC or less). Discard any that die. Shucked clams can keep for 3 days; shucked oysters for 10 days.
2. Wash hands for 20 seconds in warm soapy water before and after handling raw shellfish and before touching anything else.
3. Wash in warm soapy water anything that has been in contact with raw shellfish including all surfaces, cutting boards, tools. Sanitize with a mixture of 1 teaspoon of bleach to 3 cups of water. Rinse with clean water. Wait until dry before using or use clean towels.
4. Keep raw foods away from cooked foods. Use different plates and utensils for raw and cooked food.
5. Throw used cloths, towels into the laundry. Add a tsp of bleach to the wash.
6. Steam shellfish for 3-5 minutes after the shells begin to open; cook shucked shellfish for at least 4 minutes.

TEMPERATURE	FUNCTION
116ºC – 121ºC (240ºF – 250ºF)	Canning temperature for low-acid vegetables, meat, fish and poultry in pressure canner.
100 ºC (212 ºF)	**Boiling Point** – Temperature to cook shellfish, crabs. Temperature to can fruits, tomatoes and pickles in a water-bath.
80ºC or 180ºF	**Scalding** – Cooking temperature destroys most bacteria.
74ºC or 165ºF	**Temperature for reheating**. This temperature prevents bacterial growth, but allows the survival of some bacteria.
10ºC to 60ºC (60 ºF to 140ºF)	Danger Zone - Bacteria multiply quickly. Keep foods out of this temperature range. Place leftovers in the fridge after eating. It's safer to cool them down in the refrigerator.
4ºC (40ºF)	**Refrigerator temperature** - Foods should be held at or below 4 ºC to slow bacteria growth.
0ºC (32ºF)	**Freezing Point** - Freezing temperatures stop growth of bacteria but may not kill them.

FOOD HANDLING AND PREPARATION

Reduce Your Risk

In addition to careful harvesting from open beaches, how you cook and store your shellfish, and how you treat it in between, can help prevent illness. No single method works for every type of contamination, but the rules are simple. Properly cooked shellfish is safer to eat than raw shellfish.

Throw away any shellfish that don't close when you poke them.

Storage

Until Home -Keep in a cooler on plenty of ice to keep the shellfish cool if they won't be refrigerated or cooked for more than 2 hours (1 hour in hot weather).

Leftovers: Place warm leftovers in shallow containers and refrigerate. Cover when they are cool. Reheat to 74 ºC (165 ºF) before eating. Eat leftovers within 2 days.

At Home -Keep live shellfish in the lower area of the refrigerator, below cooked or other ready to eat food until cooking. Freeze shellfish whole or shucked.

In What -Keep live shellfish in leak proof containers that allow them to breathe. Cover live shellfish in damp towels.

Storage Times:

- **Raw (in the shell):** Use clams and mussels within 3 days and oysters within 7-10 days.
- **Raw (shucked):** Use clams and mussels within 2 days and oysters within 7 days.
- **Cooked**: Use cooked shellfish within 3 days.
- **Frozen**: Use frozen shellfish within 3 to 6 months.

Throw away:

- Food held at room temperature (more than 4ºC or 40 ºF) for more than 2 hours
- Throw away any shellfish that die during storage
- Clams that don't open after cooking

Oyster Cooking

In the shell:

Boil for 3-5 minutes after the shells begin to open.

On the Barbeque or over a fire:

Make sure that you bake the oysters until the shells open by themselves. Cook for 2-3 minutes longer after the shells have opened.

Shucked:

- **Boil** or simmer for at least 3 minutes until they become plump and white. The edges of oysters should curl slightly.
- **Fry** at 375 degrees for at least 3 minutes.
- **Broil** 3 inches from heat for 3 minutes.
- **Bake** at 450 degrees for 10 minutes.

Safety Tips:

- *Keep shellfish cold until you cook them.*
- *Throw away any shellfish that don't close when you poke them (before cooking).*
- *You can store live oysters for up to 10 days; shucked oysters can be stored up to 7 days.*

Preparing Shellfish Safely

1. **Pull up sleeves** to prevent your clothes from contaminating the food.

2. **Wash hands** for 20 seconds in warm soapy water before and after handling raw shellfish and before touching anything else.

3. Wash in **warm soapy water** anything that has been in contact with raw shellfish including: counters, cutting boards, and knives. Use a mixture of 1 teaspoon of bleach to 3 cups of water to clean up. Rinse with clean water.

4. Keep raw foods away from cooked foods. Use **different plates** and utensils for **raw and cooked** food.

5. Throw **dirty cloths and towels** into the **laundry**. Add 1 tsp of bleach to the wash to sanitize kitchen cloths and towels.

6. If it is not clean, **don't let it touch** cooked shellfish or any other food that will be served raw.

Clam Cooking

Wash shellfish before cooking to remove dirt.

In the shell:

Cook for another 3-5 minutes after the shells begin to open.

Shucked:

- **Boil** or simmer for at least 3 minutes until they become plump and white.
- **Fry** for at least 3 minutes.

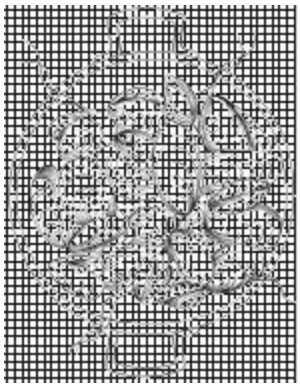
Safety Tips:

- *Keep shellfish cold until you cook them.*
- *Throw away any shellfish that don't close when you poke them. (before cooking)*
- *Use fresh clams or mussels within 3 days; use shucked clams or mussels within 2 days.*

Safety Tip:

Always cut off the black tips of the siphon or nose of Butter clams. This helps to reduce the risk of becoming ill from PSP.

Cooking



Proper cooking is the easiest way to prevent illness from eating shellfish that are contaminated by bacteria and viruses.

In the shell:

After the water boils, cook for another 3-5 minutes after the shells begin to open. Do not cook too many in the same pot because the clams and mussels in the middle may not get fully cooked.

Throw out any shells that do not open during cooking.

On the Barbeque or over a fire:

Make sure that you bake the oysters until the shells open by themselves. Cook for 2-3 minutes longer after the shells have opened.

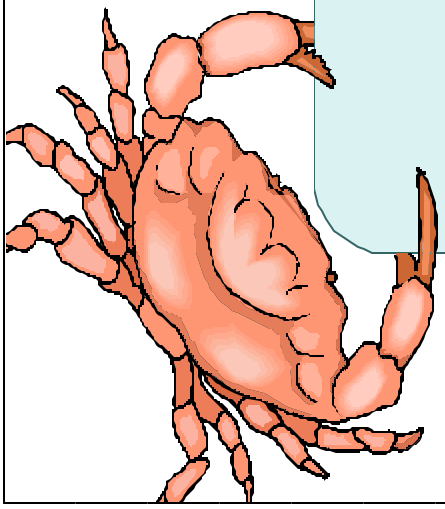
Shucked:

- **Boil** or simmer for at least 3 minutes until they become plump and white. The edges of oysters should curl slightly.
- **Fry** at 375 degrees for at least 3 minutes.
- **Broil** 3 inches from heat for 3 minutes.
- **Bake** at 450 degrees for 10 minutes.

Cooking Crabs

1. Stun and break the crabs before cooking.
2. Remove the green guts.*
3. Bring water to a boil.
4. Add crab.
5. Cook 5 minutes per pound in simmering water. This is about 15 to 20 minutes for a Dungeness crab.

**Removing the guts before cooking keeps toxins from steaming back into the body and legs. Contaminants like dioxins, furans and heavy metals (like cadmium) build up in the guts.*



Cooking and PSP

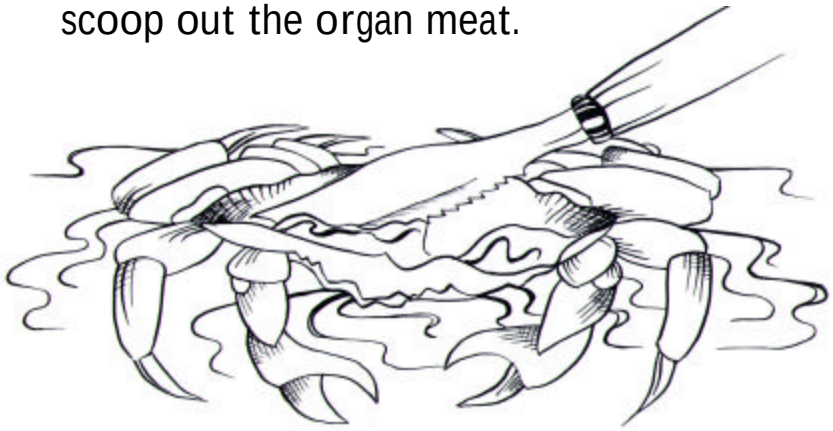
To reduce risk of PSP, remove Butter clam siphons before cooking.

Cooking does not reduce the risk of PSP in shellfish. When preparing butter clams, always be sure to cut off the black tips of the siphon or neck. Saxitoxin tends to remain there and removing this area helps to reduce risk of becoming ill from PSP. Check your area to see if there is a healthy advisory for crab hepatopancreas (guts).

Crabs

Hepatopancreas *-An organ in crabs that acts like a liver, gathering toxins from the blood and storing them.*

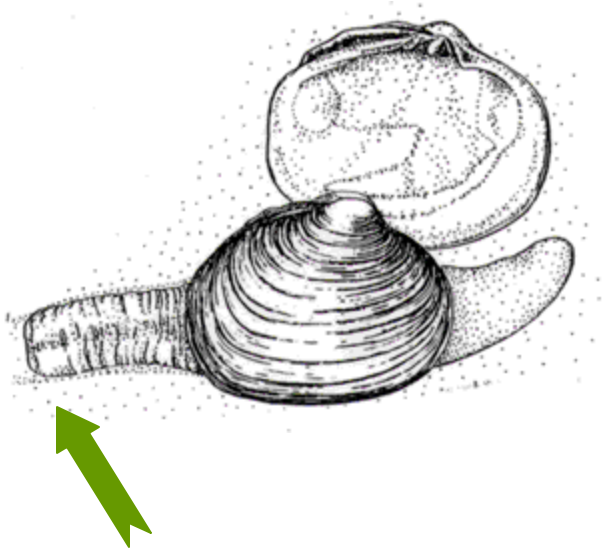
- POPs build up in the organ meat or hepatopancreas of the crab. Removing it before cooking keeps the toxins from steaming back into the body and legs
- The best way to clean a crab is to first stun it by hitting the underside against the corner of a counter and then pull off the back shell and scoop out the organ meat.



Paralytic Shellfish Poisoning
Reduce your Risk

These cooking tips will help reduce your risk.

1. Before cooking **Butter clams**, remove the dark parts that you can see, like the siphon (nose).
2. Bring water to a boil. Cook clams for 5 minutes.
3. Throw away the cooking water as it can contain PSP.



Throw this away

Talk to a Fisheries or Resource Officer
about where to harvest.

Glossary

Illnesses Associated with Contaminated Shellfish

Illness/ Diagnosis	Contaminant	Prevention	Source	Symptom	Sickness starts in	Lasts for:
Paralytic Shellfish Poisoning	Saxitoxin	**Check for shellfish closures for PSP**	Algae	Tingling, numbness, paralysis, respiratory arrest **Death if not quickly treated**	30 minutes to 2 hours	Weakness can last for weeks Death can occur in 12 to 24 hours
Salmonella	Salmonella bacteria	**Cook**	Human and animal waste	Fever, chills, headache, muscle and joint aches, pink spots on abdomen and back	1 to 3 weeks	4 weeks
Gastroenteritis	Vibrio	**Cook**	Human sewage	Nausea, vomiting, fever, diarrhea, abdominal cramps. Possible blood and mucus in their stools. Dehydration, shock and **possible death**	1 -4 days	2 - 7 days
Gastroenteritis	Norwalk-like virus	**Cook**	Human sewage	Nausea, vomiting, diarrhea, abdominal pain, headache, fever	Immediate	1-2 days
Hepatitis	Hepatitis A	**Cook**	Human sewage	Fever, nausea, sudden weight loss, abdominal pain, jaundice	1to 7 weeks	1 – 2 weeks although may last for several months

Glossary

Alexandrium	*The group (genus) of algae that produce saxitoxins, the chemical that causes Paralytic Shellfish Poisoning.*
Algae	*Tiny plants that live in water, either fresh water or the ocean. Also called phytoplankton, they are the main source of food for bivalve (clams, mussels, oysters, etc.) shellfish.*
Anemia	*An illness that results when the number of red blood cells is lower than normal.*
Bioaccumulation	*The build up of a substance (like a toxin) in the tissues of a living plant or animal. Usually through natural life processes like breathing or eating.*
Bivalve	*"Having two shells". A term used to describe the group of shellfish that has two shells, for example: clams, cockles, oysters.*
CFIA	*Canadian Food Inspection Agency. The CFIA is responsible for monitoring, reporting and enforcing food safety, animal health, and plant protection throughout Canada.*
Consumption limits	*Recommendations from Health Canada about how much of a certain seafood it is considered safe to eat.*

Depuration	*Removal of contaminants, especially fecal coliform bacteria. In shellfish, this occurs by flushing them with clean seawater in the wild (naturally) or with sterilized seawater in a processing plant.*
DFO	*Fisheries and Oceans Canada. DFO is responsible for enforcing shellfish closures and participates in determining openings and closures.*
Diabetes	*Type 2 diabetes is the most common form of diabetes mellitus. People with type 2 diabetes produce insulin, but either do not make enough insulin or their bodies have difficulty using the insulin. Usually people with this type of diabetes are overweight. Type 2 diabetes can be controlled by diet and exercise. Medication may also be needed. Type 2 diabetes is not just an adult problem anymore; more overweight children and adolescents are also developing type 2 diabetes.*
Domoic Acid	*A toxic chemical that is sometimes produced by phytoplankton of the genus Pseudonitzschia. It is responsible for an illness called Amnesiac Shellfish Poisoning.*
EC	*Environment Canada. EC is a federal agency that has the administrative responsibilities for the classification (open, closed, prohibited, etc.) of shellfish growing areas in British Columbia.*
Fecal coliform bacteria	*Single-celled animals that are naturally present in the gut of humans, mammals, and some birds. They pass from the gut and into the environment through sewage or runoff.*

Food group	*Nutritionists commonly group food into 4 different groups.* Foods *containing similar nutrients are grouped together. The Canada Food Guide to Healthy Eating explains the 4 food groups.*
Genus	*A formal name for a group of animals (species) that are closely related, but do not reproduce together.*
Gonads	*A name for both the male (sperm-producing) and female (egg-producing) sex organs.*
HABs	*Harmful Algal Blooms. Rapid growth of algae that produce toxins or otherwise cause harm to animals, people, or industry.*
Hepatopancreas	*An organ in crabs and other crustaceans that acts like a liver, gathering toxins from the blood and storing them.*
Iron deficiency anemia	*The number of red blood cells is lower than normal because a person isn't getting enough iron. People with anemia feel very weak and tired.*
(µg) microgram	*1 / 1000th of a gram*
Mouse Bioassay	*A test to discover the strength of a substance (saxitoxin for PSP) by comparing its effects on a specific strain of mouse to the effects of a known strength of the same substance.*
Nutrient	*Nutrients are substances in food that keep us healthy. They are grouped into 6 categories: protein, fat, carbohydrate (starch and sugar), vitamins, minerals and water.*

Obesity	*Having a high amount of body fat. A person is considered obese if he or she has a body mass index (BMI) of 30 kg/m^2 or greater.*
Organochlorine	*The family of chemicals that are made mainly of carbon & hydrogen atoms and have at least one chlorine atom*
Overweight	*Body weight comes from fat, muscle, bone, and body water. Overweight means being too heavy for one's height. It is defined as a body mass index (BMI) of 25 up to 30 kg/m^2. Overweight does not always mean overly fat.*
Pathogen	*Any substance, particularly bacteria or viruses that causes disease.*
Protein	*Protein is an essential nutrient that helps build many parts of the body, including muscle, bone, skin, and blood.*
Saxitoxins	*A group of chemicals produced by algae of the genus Alexandrium. The chemicals are harmful to humans and animals and cause Paralytic Shellfish Poisoning.*
Siphon	*The part of clams and cockles that extends beyond the shell. Used to bring oxygen and food into the shellfish. It is sometimes called the neck.*
Sanitary Closures	*Notices that forbid shellfish harvesting on beaches with high fecal coliform bacteria counts. Put in place whenever water quality does not meet the standards for 'approved' or open status.*

Frequently Asked Questions

PSP Frequently Asked Questions

What is PSP?

Paralytic shellfish poisoning is an illness caused by eating contaminated shellfish, like clams, mussels, and oysters. Most shellfish eat by filtering seawater for tiny plants (phytoplankton). Sometimes the plants produce toxins that can stay in their body and organs. The toxins rarely harm the shellfish.

The amount of toxins can sometimes become dangerous, even fatal, to humans and other animals.

PSP toxins affect nerves, causing tingling and numbness of the tongue, lips and fingertips. This can be followed by a spreading numbness in the limbs and paralysis of muscles needed for breathing. Death can occur within 12-24 hours.

www.pac.dfopo.gc.ca/ops/fm/shellfish/biotoxins/closures/default_e.htm

What is the risk of eating shellfish with PSP?

All over the world, harmful algal blooms which cause PSP are becoming more frequent and widespread. To reduce the risk of eating contaminated shellfish, CFIA carries out a monitoring program throughout the year. If tests in an area indicate that there is toxin in the shellfish, they close those areas to harvesting.

How can I find out about where it is safe to harvest?

Your Resource Manager and Fisheries Program staff have up to date information on closures. Ask them for recommendations on where and what to harvest. You can also check the DFO website shown at left, or call the toll free line:

1-866-431-3474

Are there any shellfish that are riskier to eat?

Butter clams and scallops hold toxins in their systems for longer than clams and mussels. Avoid eating the roe of the scallop and the black tips of

the neck of butter clams. These are the parts of the animal where toxins tend to stay.

How quickly will I notice PSP symptoms?

Usually within 5-30 minutes of eating.

How long can the symptoms last?

The initial symptoms happen quickly. If you recover, the feeling of weakness can last for weeks.

Can you test for PSP by chewing a bit of clam and waiting a few minutes to see if your lips start to tingle? Is it safe to eat the clams if tingling doesn't happen?

No. You can still get sick even if you don't notice any tingling in your lips after trying a bit. Lip tingling does not always happen in people who get ill from PSP. Changes also happen in the stomach that make the toxin more dangerous than it is in the mouth.

What should I do if think I have PSP?

Induce vomiting. Drink warm saltwater or Syrup of Ipecac to empty your stomach. Go to the HOSPITAL IMMEDIATELY. Paralysis of breathing muscles and death can happen within 2-12 hours. 15% of poisonings are fatal.

Can you tell by looking at the water if there is a harmful algal bloom?

No. The words 'red tide' are often used to say there is a harmful or toxic algal bloom. A harmful bloom can happen without a change of colour in the water. Some blooms that change the colour of the water are NOT toxic. You cannot tell just by looking. CFIA monitors for PSP by testing mussels to measure how much toxin is in the water.

How long does it take for shellfish to clear itself (depurate) of PSP after a harmful algal bloom is over?

This can be hard to know as blooms can happen

over again, so shellfish will take up toxins again. Different shellfish clear the toxins at different rates. Mussels are the fastest and Butter clams are the slowest. Shellfish living on the bottom will also take in toxins through the sediment. CFIA continues monitoring and will reopen the harvest when it is safe again.

Can shellfish remain toxic after a bloom is over?

Yes. Some toxin stays in the meat and the organs after the bloom finishes. Toxic algae form cysts that stay in the sediment during most of the year. Bottom dwelling shellfish like Butter clams can take these in and continue to build up PSP toxin in their bodies.

Can I tell if a clam is poisonous?

NO -They don't **look, smell** or **taste** any different.

Can I make shellfish safe from PSP by cooking or freezing?

No, the poison is not destroyed by boiling or freezing. Removing the siphon before cooking can remove much of the toxin, but there might still be enough to hurt you.

Useful Contacts and Resources

Useful Contacts and Resources

Agencies

Canadian Food Inspection Agency

Home Page:	*http://www.inspection.gc.ca/*
Phone:	*Tel: (604) 666-6513*
	Fax: (604) 666-1261
24 hour shellfish line	*Tel: (604) 666-2828*
Address	***BC Coastal*** *4321 Still Creek Dr.,* *Suite 400* *Burnaby, BC* *V5C 6S7*

Fisheries and Oceans Canada (Pacific Region)

Home Page:	*http://www.pac.dfo-mpo.gc.ca/*
Phone:	*Tel: (250) 754-0230*
	Fax: (250) 754-0309
Address	***Nanaimo** (Front Street)* *60 Front Street,* *Nanaimo, BC* *V9R 5H7*

Health Canada
Health Products and Food Branch
Food Directorate
Bureau of Chemical Safety
CHEMICAL HEALTH HAZARD ASSESSMENT DIVISION

Phone: *Tel: (613) 957-1314*

Fax: (613) 957-1688

Address 251 promenade Sir Frederick Banting Driveway,
Tunney's Pasture Ottawa, Ontario
Canada K1A 0K9

Health Canada
First Nations and Inuit Health
Primary Health Care and Public Health
Environmental Contaminants Research

Phone: Tel: (613) 941-5748

Fax: (613) 954-0692

Address 200 Eglantine Driveway,
Tunney's Pasture
Ottawa
Canada K1A 0K9

Agencies, cont'd

ENVIRONMENTAL HEALTH SERVICES
First Nations and Inuit Health Branch

Phone:	*Tel: (604) 666-7313*
	Fax: (604) 666-3356
Address	1138 Melville Street Vancouver, British Columbia Canada V6E4S3

Environment Canada (Pacific & Yukon Region)

Home Page:	*http://www.pyr.ec.gc.ca/*
Phone:	*Tel: (604) 664-9100*
	Fax: (604) 713-9517
Address	***British Columbia*** *Communications* *401 Burrard Street* *Vancouver, BC* *V6C 3S5*

Websites

Nutrients in Shellfish

USDA Nutrient Data Laboratory
www.nal.usda.gov/fnic/foodcomp/

Food Composition Table for Use in East Asia 1972
www.fao.org/docrep/003/X6878E/X6878E00.htm

Contaminants in shellfish

Shellfish Contamination Closures
www.pac.dfo-mpo.gc.ca/ops/fm/shellfish/Biotoxins/closures/default_e.htm

PSP Biotoxins
www.pac.dfo-mpo.gc.ca/ops/fm/shellfish/Biotoxins/closures/PSP_e.htm

Environment Canada. Shellfish and Water Quality
www.ns.ec.gc.ca/epb/factsheets/sfish_wq.html

Oceanus magazine, Woods Hole Oceanographic Institution
oceanusmag.whoi.edu/index.html

Understanding Red Tides
www.fathom.com/course/10701012/index.html

Contaminated Sediments
www.envirotools.org/factsheets/contaminatedsediments.shtml

Websites, cont'd

Harmful Algal Blooms
www.whoi.edu/science/B/redtide/whathabs/whathabs.html
www.pac.dfo-mpo.gc.ca/ops/fm/shellfish/Biotoxins

Persistent Organic Pollutants
www.ec.gc.ca/pops/brochure_e.htm
www.ec.gc.ca/CEPARegistry/documents/policies/POPs_Backgrounder.cfm
www.chem.unep.ch/pops/default.html
www.envirohealthaction.org/toxics/pollution/

FOOD SAFETY

Foodborne Pathogenic Microorganisms and Natural Toxins Handbook (US FDA)
http://www.cfsan.fda.gov/~mow/intro.html

Foodborne Illness and Safety. U.S.D.A.
www.cfsan.fda.gov/~mow/sea-ill.html

Partnerships for Food safety education
www.fightbac.org/main.cfm

Cooking Times for Shellfish
http://world.std.com/~kcl/Rshellfishcook.html

ADDITIONAL RESOURCES FOR NEWSLETTERS

Alaska Seafood Grant
http://www.uaf.edu/seagrant/issues/PSP/psp_page.html

Websites, cont'd

BeachWatch Water Quality Series
http://www.iisgcp.org/aquaecol/beach/beach.htm