



Nutritional Benefits of Seafood

Elizabeth Reames¹

Seafood is a healthful choice for people of all ages—growing children, pregnant women, active adults, and the elderly. Seafood is an excellent source of lean, high quality, easily digested protein. A 3.5-ounce serving of seafood provides almost half of an adult’s daily protein needs for only 100 to 200 calories. Seafood is low in saturated fat and sodium and is a rich source of many essential vitamins and minerals. Seafood also is one of the few foods that contain long-chain omega-3 fatty acids, which have many beneficial health effects and are essential for the development of the nervous system and retina.

Seafood includes fish such as catfish, salmon, tuna, trout and tilapia, and shellfish such as shrimp, crab, clams and oysters. Most of the seafood purchased in the United States comes from marine waters and from aquaculture (farm-raised fish).

Nutritional and health benefits of seafood

The fats in red meat, poultry and eggs are solid fats, while the fats in seafood, nuts and seeds are oils. The 2010 Dietary Guidelines for Americans recommend decreasing our intake of solid fats (saturated fats, *trans* fats and cholesterol) because they may raise the levels of blood lipids such as total cholesterol and LDL cholesterol; increase the risk of heart disease, stroke and some cancers in adults; and lead to excess weight gain. Studies show that eating seafood can decrease the risk of heart attack, stroke, obesity and hypertension. Seafood is low in saturated fat and higher in “heart healthful” polyunsaturated fat, including omega-3 fatty acids.



Boiled crawfish platter. (photo provided by W. Ray McClain, LSU Ag Center)

The most important omega-3 fatty acids in seafood are eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA). All seafood contains omega-3 fatty acids, but oily fish such as salmon, sardines, trout, Atlantic and Pacific mackerel, and herring are especially rich sources of EPA and DHA. These fatty acids can help lower blood pressure and heart rate and improve cardiovascular function. For example, research has shown that omega-3 fatty acids decrease the risk of arrhythmias (abnormal heartbeats) that can lead to sudden death. Omega-3 fatty acids also decrease triglyceride levels and slow the growth rate of atherosclerotic plaque.

Eating 8 ounces per week (about two servings) of a variety of seafood provides an average consumption of 250 milligrams per day of EPA and DHA, which is associated with reduced cardiac deaths among individu-

¹Professor and Extension Specialist (Nutrition), LSU Ag Center

als with and without pre-existing cardiovascular disease. This is the basis for the recommendation from U.S. health organizations to eat two servings of seafood per week.

The 2010 Dietary Guidelines for Americans recommend limiting cholesterol intake to less than 300 milligrams per day. Some evidence shows a relationship between higher intake of cholesterol and higher risk of cardiovascular disease, although the potentially negative effects of dietary cholesterol are small compared to those of saturated fat and *trans* fatty acids. The amount of dietary cholesterol found in fish is comparable to levels in beef, pork and chicken, but most fish have less saturated fat than meat. Although shellfish contains more cholesterol than fish, meat and poultry (179 milligrams of cholesterol in a 3-ounce serving of shrimp compared to 79 milligrams in 3 ounces of beef round tip roast), the fat in shellfish is mostly unsaturated and contains a high proportion of omega-3 fatty acids that seem to significantly reduce the risk of heart disease and stroke.

In addition to lowering the risk for heart disease, research shows that the oil in seafood may help lower risk and alleviate symptoms of other chronic diseases such as rheumatoid arthritis, some types of cancer, asthma, psoriasis, and macular degeneration.

Pregnancy and lactation

The nutritional value of seafood is very important during fetal growth and development, as well as in early infancy and childhood. For pregnant women, mothers who are breastfeeding, and women of childbearing age, eating seafood is important because it supplies DHA that is beneficial for the brain and visual development of infants. According to the 2010 Dietary Guidelines for Americans, women who are pregnant or breastfeeding can improve their infants' cognitive and visual development by eating at least 8 and up to 12 ounces of seafood

per week. However, because wild fish may contain methyl mercury, women who are pregnant or breastfeeding and young children should eat no more than 6 ounces per week of white (albacore) tuna and should not eat tilefish, shark, swordfish and king mackerel.

Vitamins and minerals

The essential vitamins and minerals seafood contains include niacin, vitamin B6, vitamin E, vitamin B12, thiamin, riboflavin, zinc, phosphorus, magnesium, iron, copper, potassium and selenium. In addition, oily fish have generous amounts of vitamins A and D, while fish with bones remaining, such as canned salmon and sardines, are good sources of bone-building calcium. Fish, especially marine fish, are a dietary source of iodine.

Dietary recommendations

Based on evidence of the health benefits of consuming seafood, the 2010 Dietary Guidelines for Americans recommend eating at least 8 ounces of seafood each week (8 to 12 ounces for women who are pregnant or breastfeeding). Smaller amounts of seafood are recommended for children. The current mean intake of seafood in the United States is 3.5 ounces per week.

Seafood choices can include types with higher and lower amounts of EPA and DHA, but some choices with higher amounts should be included. The American Heart Association recommends eating fish (particularly oily fish such as mackerel, herring, sardines, albacore tuna and salmon) at least twice a week. Each serving should be 3.5 ounces cooked or about $\frac{3}{4}$ cup of flaked fish.

Farm-raised seafood can have an equal or even higher amount of omega-3 fatty acids than wild-caught seafood. The fatty acid concentration of farmed fish reflects the composition of the diets they are fed. Thus, farmed salmon are fed a rich source of EPA and DHA (e.g., fish oil or algae) to have a fatty acid profile similar to that of wild salmon.

There is no dietary recommendation for EPA and DHA, but scientists and physicians are continuing to evaluate the requirements for these fatty acids. The current daily reference intake (DRI) for omega-3 fatty acids emphasizes the adequate consumption of alpha-linolenic acid (ALA, 18:3n-3) to satisfy requirements for all ages and both genders. ALA is found in flaxseed oil and, in a lesser amount, in other sources such as canola oil, soybean oil and walnuts. The human body converts only a small amount of ALA to DHA/EPA, so to obtain the advised 250 milligrams per day of EPA and DHA it is necessary to eat the recommended amount of seafood per week.



Tilapia from greenhouse RAS. (photo provided by LSU Ag Center)

Selected nutrients in seafood and other protein food sources.

	Calories	Protein (g)	Carbohydrate (g)	Fat (g)	Saturated fat (g)	Omega-3 EPA (g)	Omega-3 DHA (g)	Cholesterol (mg)	Sodium (mg)
Finfish									
Salmon, Atlantic, farm-raised, cooked	175	18.79		10.50	2.128	0.587	1.238	54	52
Salmon, Atlantic, wild-caught, cooked	155	21.62		6.91	1.068	0.349	1.215	60	48
Tilapia, cooked (3.5 oz)	128	26.15		2.65	0.94	0.005	0.130	57	56
Trout, rainbow, farm-raised, cooked	143	20.23		6.27	1.403	0.220	0.524	60	52
Trout, rainbow, wild-caught, cooked	128	19.48		4.95	1.376	0.398	0.442	59	48
Tuna, light, canned in water	99	21.68	0	0.7	0.199	0.04	0.19	26	287 (w/o salt = 42)
Tuna, yellow-fin, cooked	110	24.78	0	0.5	0.174	0.013	0.089	40	46
Bass, striped, cooked	105	19.32	0	2.54	0.552	0.184	0.637	88	75
Catfish, farm-raised, cooked	122	15.67	0	6.11	1.348	0.017	0.059	56	101
Catfish, wild-caught, cooked	89	15.7		2.42	0.632	0.085	0.116	61	42
Flatfish (flounder and sole), cooked	73	12.95		2.01	0.461	0.029	0.122	48	309
Crustaceans									
Shrimp, mixed species, cooked (moist heat)	101	19.36		1.45	0.163	0.043	0.044	179	805
Crab, Blue, cooked	71	15.20		0.63	0.171	0.086	0.057	82	336
Crawfish, farm-raised, cooked	74	14.89		1.10	0.184	0.105	0.032	116	82
Crawfish, wild-caught, cooked	70	14.25		1.02	0.154	0.101	0.040	113	80
Mollusks									
Oysters, eastern, farm-raised, cooked	67	5.95	6.19	1.80	0.581	0.195	0.179	32	139
Oysters, eastern, wild-caught, cooked	67	7.54	3.60	2.25	0.626	0.233	0.178	53	112
Oysters, eastern, farm-raised, raw	50	4.44	4.70	1.32	0.377	0.160	0.173	21	151
Oysters, eastern, wild-caught, raw	51	5.71	2.72	1.71	0.474	0.010	0.136	40	85
Clams, mixed species, cooked	126	21.72	4.36	1.66	0.160	0.117	0.124	57	95
Mussels, blue, cooked	146	20.23	6.28	3.81	0.723	0.235	0.430	48	314
Meat and poultry selections									
Beef roast, sirloin, lean, trimmed, roasted	193	26.34		9.73	3.527	0	0	80	54
Chicken, breast meat only, roasted	165	31.02		3.57	2.020	0.010	0.020	85	74
Pork loin, boneless, roasted	164	26.46		5.67	1.887	0	0	78	48
Portion size – 3 ounces									
Dry heat cooking unless otherwise specified									
Source: USDA National Nutrient Database for Standard Reference, Release 24. 2012. Available at http://www.ars.usda.gov/Services/docs.htm?docid=8964 .									

Seafood cautions

Ensuring the safety and quality of seafood products in the U.S. is a joint effort of federal and state regulatory agencies. These agencies work cooperatively to provide consistent standards and regulations for seafood products and the various industry sectors that fish, farm, harvest and deliver these products to consumers. With any food, improper food processing and handling may introduce contaminants that cause safety concerns. Safe processing and handling practices can reduce these risks.

Microbiological hazards

All foods may contain microorganisms, such as bacteria and viruses, that may cause foodborne illness. It is important to handle seafood safely to prevent foodborne illness. Buying from a retailer who follows proper food handling practices helps ensure that the seafood you buy is safe and of the best quality.

Certain groups of people are at a greater risk for foodborne illness and should avoid eating raw or partially cooked fish or shellfish. Those at higher risk are:

- Pregnant women
- Young children
- Older adults
- Persons with decreased stomach acid
- Persons with compromised immune systems (e.g., those with HIV/AIDS, liver disease, diabetes, cancer, or gastrointestinal disorders; and people taking steroids, chemotherapy or immune system suppressing drugs)

Harmful viruses such as Norwalk virus and hepatitis A are usually linked to shellfish harvested from waters contaminated with sewage. Bacteria mostly occur in molluscan shellfish (oysters and clams) but can be present in some ready-to-eat fish products. The greatest risk comes from eating raw or partially cooked oysters or clams, which may become contaminated with bacteria such as *Vibrio vulnificus*, *Vibrio parahaemolyticus*, and other bacteria associated with land use, runoff, sewage discharges, etc. These microorganisms, which occur naturally in warm coastal waters, can cause serious illness or even death in high-risk individuals. Not all mollusks are contaminated, but there is no simple way to tell if they are. Because the diseases linked to raw shellfish are serious for vulnerable individuals, the safest practice for these people is to avoid eating raw shellfish.

Some oysters are treated for safety after they are harvested, but this information may or may not be given on the label. Even treated oysters should not be eaten raw by people at risk for foodborne illness, however. The safety treatment may remove some unsafe organisms, but not

all. Hepatitis A virus can survive light cooking, so simply steaming shellfish until the shells open may not destroy the virus if it is present.

The Food and Drug Administration and states producing shellfish regulate shellfish harvest waters under the National Shellfish Sanitation Program. This program sets water quality standards under which shellfish may be grown and requires regular testing. The program is designed to ensure that shellfish are harvested from certified waters and meet safety standards. Because of this program, illness from eating raw shellfish has become less common.

Pregnant women, older adults, and people with weakened immune systems are more susceptible to a serious foodborne illness called listeriosis, caused by the bacteria *Listeria monocytogenes*. It can be found in refrigerated, ready-to-eat foods including meat, poultry, seafood and dairy products, especially unpasteurized milk and foods made with unpasteurized milk. Listeriosis may occur from eating contaminated smoked seafood and cooked crabmeat found in the refrigerated section or in the deli area of grocery stores and other markets. The products will be labeled as “nova-style,” “lox,” “kippered,” “smoked” or “jerky.” To avoid listeriosis, people at risk should not eat raw or refrigerated smoked seafood unless it is contained in a cooked dish such as a casserole. Canned or shelf-stable smoked seafood should be even safer.

The best way to ensure that seafood is safe to eat is to cook it thoroughly. The U.S. Department of Agriculture recommends cooking fish to an internal temperature of 145 °F. The internal flesh should be opaque and separate easily. (When fish is opaque, it is no longer clear and light cannot pass through it. Opaque fish looks dull instead of shiny.)

If you choose to eat raw fish, it is best to eat fish that has been frozen. Freezing kills almost all parasites that may be found in some types of fish. But freezing will not kill all of the harmful microorganisms that may be present. Most sushi and sashimi is frozen. Ceviche is seafood marinated in lime or lemon juices and is a common dish in Latin America and Latino restaurants. While the citric acids and onion kill many pathogens, there is still a risk of illness because the seafood is not cooked.

Fish toxins

Besides viruses and bacteria, some fish—mainly species from tropical or subtropical waters—may have toxins that cause illness. The two most common types are ciguatoxin and scombrototoxin, or histamine poisoning. Ciguatoxin is found mainly in reef fish such as barracuda, grouper and snapper.

Scombrototoxin (histamine) is associated mainly with mahi-mahi, fresh tuna, mackerel and bluefish. The toxin develops when fish have not been kept cold enough after

harvesting and shipping. Symptoms of illness develop quickly but usually disappear completely within 24 hours. There is no way to tell whether a particular fish contains the toxin, and not all fish caught in the same area will have the toxin.

Methyl mercury and other contaminants

Concern about the contamination of seafood, particularly by methyl mercury, has led to recommendations that women of reproductive age and young children limit their consumption of or avoid eating certain species of seafood. Eating a variety of fish will maximize health benefits and help minimize any potentially adverse effects due to environmental pollutants.

Levels of methyl mercury are highest in older, larger, predatory fish (those that eat other fish). Seafood varieties that are higher in EPA and DHA and lower in methyl mercury include salmon, anchovies, herring, sardines, oysters, clams, trout, and Atlantic and Pacific mackerel (not king mackerel, which is high in methyl mercury). Contaminants generally are found only in very low amounts in most fish sold commercially. **Research suggests that farm-raised fish are less likely to be contaminated than wild fish.** The water sources and feed used by aquaculture farms typically contain very low levels of contaminants, and wastes are regularly removed from the aquaculture systems to avoid the accumulation of external contaminants.

Shopping for seafood

To make sure you are getting the safest seafood possible, buy fish that is refrigerated or properly iced. Look for seafood to be displayed on fresh ice, and beware when you see ice melting. Seafood should also be displayed in a case or under some type of cover.

When choosing fresh whole fish, look for these features: clear, bulging eyes; elastic, firm flesh; red gills; shining skin; and close-fitting scales. Fresh seafood should smell fresh and mild, not fishy, sour or ammonia-like.

Look for fish fillets and cutlets that have moist flesh, firm texture, and no discoloration or dryness. If touched, the flesh should spring back. Flesh that looks dull could mean the fish is old.

When selecting fresh shellfish, look for the tag or label on the packages. These tags and labels will give specific information about the product, including a certification number for the processor.

In addition, follow these general guidelines:

- Throw away any dead, cracked or broken shellfish.
- Perform the “tap test.” Clams, oysters and mussels that are alive will close up when their shells are tapped.

- Look for moving legs. Live crabs, crawfish and lobsters will show leg movement.

Storing seafood

Once you buy seafood, you should store it on ice or in the refrigerator or freezer immediately. If you will use it within 2 days, store it in the refrigerator. If you won't use it for 3 or more days after purchase, freeze it using the following guidelines:

▪ **Fillets**

Vacuum packaging is the best way to freeze fish fillets or steaks to prevent freezer burn and the development of off-flavors. If you don't have vacuum packaging equipment, use heavy-duty freezer bags or moisture-/vapor-proof plastic wrap. Place each fillet in a separate freezer bag or wrap individually in plastic wrap without adding water. Eliminate as much air as possible from the freezer bag or wrapped fish. Freeze individually wrapped fillets as quickly as possible. The frozen fish may be packed together in larger bags or other containers. Small fish with the skin on will freeze well in water. Place them in a watertight container, add ice water, and freeze.

▪ **Whole dressed fish**

Leave skin on and wrap in moisture-/vapor-proof plastic wrap, or glaze the fish. Glazing helps prevent both dehydration and freezer burn. To glaze, freeze the fish quickly, remove from the freezer, and dip in ice-cold water. The water freezes and forms a thin layer of ice. To protect the glaze from cracking or chipping, wrap fish with freezer paper or heavy-duty aluminum foil.

▪ **Shrimp**

Shrimp can be frozen raw or cooked, shell on or off. For maximum storage life and quality, freeze shrimp raw with heads removed but shells still on. Be sure to wash and drain the shrimp if frozen uncooked. Shrimp also may be frozen in water in a freezer container or plastic zippered bag.

▪ **Crabmeat**

Freeze cooked crabmeat in a sealed bag (preferably vacuum sealed). To prevent flavor and texture loss, do not add water.

▪ **Crawfish**

Peel cooked or blanched crawfish tails and rinse with cold water to remove all fat. To blanch, put live crawfish in boiling water that covers them, bring back to a boil and boil for 7 to 8 minutes in a large pot. To prevent darkening, dip peeled tails in a solution of lemon juice and water (½ cup lemon

juice to 1 quart water.) Drain and package in freezer bags, removing as much air as possible.

▪ **Oysters**

For use in cooked or baked products, freeze oysters in juice in freezer bags or freezer containers.

Recommended storage times for seafood

	Refrigerator	Freezer
Fish	1 to 2 days	3 to 8 months
Shellfish	1 to 2 days	3 to 12 months

Thawing seafood

Thaw frozen seafood in the refrigerator on the bottom shelf in a leak-proof container to prevent dripping on other foods. Or, thaw it under cold running water or in the microwave oven following the manufacturer's guidelines. Cook immediately after thawing. Never thaw seafood on the counter at room temperature.

Conclusion

Seafood is a high-protein food that is low in calories, total fat, and saturated fat. High in vitamins and minerals, seafood has been shown to have numerous health benefits. It reduces the risk of cardiac disease for the general population and provides essential nutrients during fetal growth and development. Based on evidence of these health benefits, the 2010 Dietary Guidelines for Americans include a new quantitative recommendation for seafood intake. The Guidelines recommend that consumers eat at least 8 ounces of seafood each week and that women who are pregnant or breastfeeding eat 8 to 12 ounces of seafood per week. Smaller amounts of seafood are recommended for children.

Selected references

Cornell University and the New York Sea Grant Extension Program. 2012. "Seafood Health Facts." Available at <http://seafoodhealthfacts.org/>. Accessed in 2012.

Kris-Etherton, Penny; William S. Harris, and Lawrence J. Appel. "Fish Consumption, Fish Oil, Omega-3 Fatty Acids and Cardiovascular Disease." Available at <http://circ.ahajournals.org/cgi/content/full/106/21/2747>. Accessed in 2011.

Malden C. and A.L. Yaktine, eds. "Seafood Choices: Balancing Benefits and Risks." Washington, D.C.: National Academies Press. Free Executive Summary available at http://www.nap.edu/catalog.php?record_id=11762. Accessed in 2011.

National Oceanic and Atmospheric Administration. "Seafood and Your Health." Available at <http://www.google.com/search?q=Seafood+for+the+Health+of+it&rls=com.microsoft:en-us&ie=UTF-8&oe=UTF-8&startIndex=&startPage=1>. Accessed in 2011.

The National Academies. "Health Benefits Associated with Nutrients in Seafood." Available at http://books.nap.edu/openbook.php?record_id=11762&page=48. Accessed in 2011.

U.S. Department of Agriculture/U.S. Department of Health and Human Services. "Dietary Guidelines for Americans 2010." Available at www.dietaryguidelines.gov. Accessed in 2011.

U.S. Department of Agriculture. National Nutrient Database for Standard Reference, Release 24. 2012. Available at <http://www.ars.usda.gov/Services/docs.htm?docid=8964>.

U.S. Food and Drug Administration. "Fresh and Frozen Seafood. Selecting and Serving It Safely." Available at <http://www.fda.gov/food/resourcesforyou/consumers/ucm077331.htm>. Accessed in 2011.

World Health Organization. 2010. "Joint FAO/WHO Expert Consultation on the Risks and Benefits of Fish Consumption." Available at <http://www.fao.org/docrep/014/ba0136e/ba0136e00.pdf>. Accessed in 2012.

SRAC fact sheets are reviewed annually by the Publications, Videos and Computer Software Steering Committee. Fact sheets are revised as new knowledge becomes available. Fact sheets that have not been revised are considered to reflect the current state of knowledge.



United States Department of Agriculture

National Institute of Food and Agriculture

The work reported in this publication was supported in part by the Southern Regional Aquaculture Center through Grant No. 2008-38500-19251 from the United States Department of Agriculture, National Institute of Food and Agriculture.