Choosing Seafood for Health Care

A WHITE PAPER FROM HEALTH CARE WITHOUT HARM

Health care facilities serve seafood as a source of lean protein, but do they know where the seafood they buy comes from? Is it safe and free from contaminants? Is it harvested in a way that protects the ocean's ecosystems and our future supply of seafood? Wild seafood caught by industrial-scale vessels can extract too many fish and threaten ecosystem health. Farmed fish, or aquaculture, can also threaten ecosystems and contribute to antibiotic resistance. Our reliance on imported (often untraceable) seafood unwittingly exposes us to chemicals and antibiotic-resistant bacteria and supports labor and environmental practices inconsistent with the values of the health care sector.

Third party certifications and guidelines are a good first step for identifying seafood with improved standards. Many major food distributors and food service management companies utilize Marine Stewardship Council and others to identify more responsible choices. However, the best approach to choosing seafood is to go deeper and follow the principles used for land-based foods. Health Care Without Harm worked closely with the Northwest Atlantic Marine Alliance (NAMA) to develop seafood recommendations for health care facilities that protect the health of individuals, communities, and the environment. This environmental nutrition approach considers social, economic, and ecological issues that shape our food system.

A simple, commonsense strategy is to **"know your fisherman"*** or at least to **"know your fish."** When buying seafood, prioritize local and seasonal, preferably wild caught. Fortunately, there

are emerging alternatives to the global fish trade, and there are viable sources of local, wild seafood available to health care. When purchasing seafood, follow these five principles:

1. **Buy a diversity of seasonally available species.** Seafood, like most foods, is seasonal. Many coastal states now have seafood calendars that show when it's best to catch and buy certain species because of their natural spawning, migration, and abundance cycles. When you buy seafood seasonally, you can support fishing communities by buying what they are catching at a given time. For example, as a seafood buyer, you might request a seasonal white fish in place of a specific species. By doing this you are purchasing according to natural cycles and what fishermen are catching. You are also likely to get a better price by buying seasonally.

2. **Buy "underutilized" species.** Understandably, when it comes to food, we often stick to what we know. However, when we focus on the same few species such as cod, salmon, shrimp, and tuna, we put a greater strain on those species, drive up demand and the price, and make it difficult for

* We use fisherman/men in this document as a gender-neutral term to describe a person or people who fish. We considered using "fisher," however we received feedback from fishing communities that fisherman is the preferred term among females who fish.

fisherman to sell what is in abundance during that season. In New England, for example, over 60 species are brought to shore, many of which are an easy substitute for cod.

3. **Buy local/domestic, wild-caught finfish and shrimp from small and mid-sized vessels.** While aquaculture practices are improving, most of the farmed fish we eat are raised abroad where standards and enforcement of standards vary. Common to the international food marketplace, only about two percent of seafood imports are inspected, meaning there is risk when buying imported seafood. More and more, we are finding that our local community-based fishermen are better stewards of the sea than "big seafood" companies that may have no tie to local communities and low motivation to protect local resources. Buying local supports and preserves local fishing communities that are increasingly under threat of consolidation from larger-scale operations.[1]

4. **Connect with community seafood organizations:** It's getting easier to have access to local seafood. To find sources of seafood near your facilities you can also visit www.LocalCatch.org, www.marketyourcatch.msi.ucsb.edu, or http://www.fishlineweb.com. Other resources are coming online in the near future. NAMA works with fishing communities throughout North America and their staff is available as a resource.

5. **Talk to your distributor:** Ask for lesser-known species that are caught in the waters near you, or ask for the source of their seafood if it's not domestic and local. Request the name of the boat that caught your fish in order to ensure traceability. Share your commitment to making sure fishermen are paid a fair price for their catch and ask how they can support that effort.

FROM OCEAN (OR FISH FARM) TO PLATE

Like most of our food, seafood goes on a journey from the point of being harvested to its final destination on our plates. On that journey, whether it begins in your own coastal waters or at a shrimp farm in Thailand, it passes through regulatory agencies before reaching our kitchens. The Magnuson–Stevens Fishery Conservation and Management Act, is the primary law governing marine fisheries management in United States federal waters. It was put in place to prevent overfishing and rebuild overfished stocks. The Act established eight fishery management councils that, using stock assessments, set the harvest and operational requirements for each fishery. The National Oceanic and Atmospheric Administration (NOAA) governs the process, and enforces the catch limits and other regulations established by the Magnuson-Stevens Act. NOAA is also one of the primary agencies charged with permitting and overseeing aquaculture or fish farming in the US. The Food and Drug Administration (FDA) is responsible for addressing food safety for domestic and imported fish.

While these agencies have sometimes been effective in monitoring the safety of our food and protecting our ocean resources, the system does not work perfectly. A very small amount (approximately two percent) of imported seafood is inspected for safety, and some management strategies have led to consolidation in the fishing industry. As a purchaser you can take action to ensure the safety and sustainability of the seafood you buy. Begin by asking, is the product domestic or imported? Is it harvested wild from the ocean or from a farm? These questions will help you determine the right choice for your facility.

DOMESTIC VERSUS IMPORTED

The US produces approximately 4.5 million metric tons of seafood annually,[2] yet 90 percent of the seafood Americans consume is imported, meaning that we eat very little of what we catch and export the majority.[3] The US imports seafood from all over the world, with Asia accounting for the largest share (52 percent of imports).[4] Imported seafood represents an important source of nutrition for Americans, and can often be found at a lower price point, however, because of the "anonymity" of imported seafood, we may end up supporting practices that are destructive to human health and the environment.

Labor Conditions

Major US news outlets such as the New York Times,[5] the Washington Post,[6] and CNN[7] have reported on slave labor in the international fishing industry. Fishing in the South China Sea, and specifically Thailand, has been identified as an area with the most brutal offenses. Ship captains capture and enslave boys and men in order to address the chronic labor gap and meet the demand for shrimp and fishmeal.[8] Thai shrimp farms have diverted demand from the formerly prominent US wild shrimp fisheries by flooding the market with cheaply produced farmed shrimp.[9] These low cost shrimp come not only at the expense of slave labor and brutal working conditions, but also at major ecological cost.[10]

Reports show shrimp-farm workers are subject to non-payment and violation of minimum wage laws, inhumane work hours, dangerous and unsanitary working and sleeping conditions, deprivation of food, lack of medical treatment for illness and injuries (infections are common and often chronic), beatings and reported cases of murder, child labor, and systematic denial of freedom of association and collective bargaining.[11] In addition, in countries like Bangladesh, land is taken away from farmers forcibly to be flooded with seawater to accommodate these shrimp farms. As a result, farmers who were once able to grow their own food and graze their farm animals on their own land no longer have access to their own land and clean water. Livestock are lost due to lack of fresh water and food, children are malnourished and families are living poverty.[12]

The monitoring of working conditions on boats and in factories remains difficult and often unreliable. Once fish arrive at a dock, it is often too late to know whether it was acquired from an illegal fishing boat or not.[13] Until the laws are strengthened and/or third party certifiers or government inspectors can identify and exclude seafood produced by slave labor from the market entirely, purchasing from small and medium scale fishermen, distributors, and processors remains the safest alternative.

Illegal Imports

Imported seafood sources are inherently less traceable than domestic sources of seafood, making food safety, production, and harvesting practices harder to assess. Moreover, research has found that 20-30 percent of wild seafood imported to the US is caught illegally. Illegal fishing broadly refers to fishing in violation of existing laws, such as the use of unregistered ships ('ghost ships'),[14] harvesting illegal quantities of seafood, banned species, or the use of illegal harvesting methods. The global illegal fishing market represents 35 percent of global catches,[15] and US purchases account for 4-16 percent, making the US a significant funder of the global illegal fishing market. Illegal fishing compromises the livelihoods of honest fisherman, depriving them and their communities of up to $23 billion annually of potential earnings. It also evades all forms of regulation and reporting, compromising ecosystems and long term food security.[16] Finally, illegal fishing is associated with international crime including slavery at sea and narcotic trafficking.[17] This presents major concerns associated with eating imported seafood; another reason to "know your fisherman."

Problems with Labeling Imports

Seafood source labeling is regulated by the US government under the "country of origin labeling" requirements, effective since 2005. Despite the existence of seafood import regulations, only two percent of seafood in the US is examined for labeling and documentation, as compared to 20-50 percent in the EU.

FARMED VERSUS WILD

Seafood can be categorized as "farm-raised" through aquaculture production systems or "wild." Aquaculture refers to seafood that is raised in artificial confinement, ranging from human-made ponds and tanks to confined zones in freshwater and marine environments.[18] Wild seafood includes all other forms of harvesting, wherein wild stocks are caught and sold. Like aquaculture, the harvesting practices of wild fishing vary enormously. Some high-volume harvesting practices have been associated with the long-term devastation to marine ecosystems. Other practices can assist in maintaining healthy fish stocks and fishing communities over the long-term.[19]

Overfishing and Consolidation

The global fishing industry relies on a wide variety

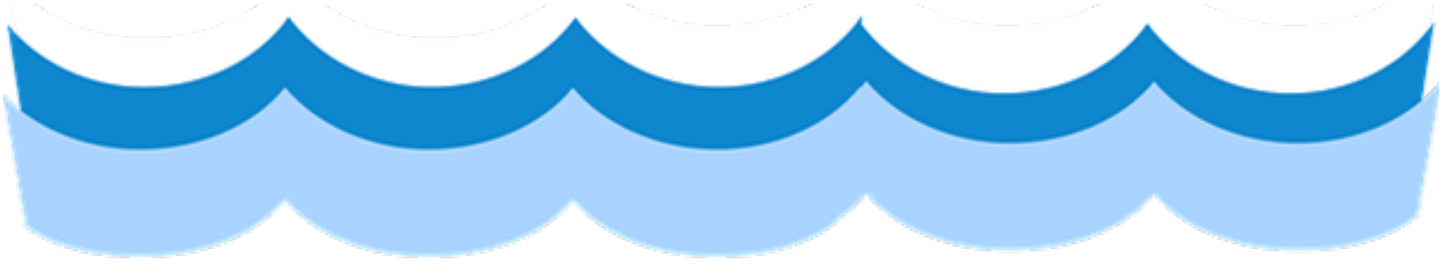
of gear and practices using fish nets, cages, hooks and even harpoons to catch seafood. Some common equipment includes trawls, dredges, seine nets, and long lines.[20] Certain fishing gear in certain ecosystems can be more destructive than others resulting in overfishing of the targeted species, high levels of bycatch (untargeted species that are thrown back to sea, often dead), and major disturbances to the ocean ecosystems, which threatens future stocks. However, the degree to which gear can be destructive depends on how, where, and at what scale they are used. For example trawling, where a net is dragged behind a boat or boats, can be more destructive when dragged along indiscriminately without attention to the unique characteristics and differences in the seafloor or the mid-water column. Even a hook and line operation, a relatively benign technology, can be destructive when too many hooks are used or the hooks are set in the wrong part of the water column.

Certain gear has inherently less environmental impact. For example, traps laid down on the seafloor are used for many crustaceans like lobster and shrimp, and are generally better for the environment. Stationary weirs, used for generations by native communities, are the most passive form of fishing, and almost all species that aren't brought onto boats return to sea alive. Trolling with hooks can be less harmful when skilled fishermen take care to release the animals they are not keeping to sea quickly and alive.

The nuances in how gear is used can make choosing environmentally responsible seafood difficult. However, much of this ambiguity can be addressed through scale. **Researchers and international guidelines from the Food and Agriculture Organization of the United Nations (FAO) have promoted community-led, small-scale fisheries as a solution to these problems in order to maintain healthy stocks and build more resilient and sustainable fisheries and ecosystems.**[21] This guidance is in contrast to current trends in fisheries where there has been increasing consolidation of fishing businesses, ownership of fishing rights, smaller numbers of active small and medium scale vessels, fewer gear types, and increasingly large, industrial scale ships using the monoculture approach to fishing by employing gear that can catch too much of a single species at one time. This consolidation of ownership has been linked to "catch share" systems of fisheries management that work by providing harvesting or access rights to fishermen. In contrast to catch limits, which put a cap on the number of fish that can be harvested in a fishery, catch shares limit who has access to a fishery. Critics claim that catch shares have led to the privatization of a public resource, and have allowed the most powerful fishing firms to gain control and push smaller fleets out. While some experts maintain that catch shares protect fisheries, others credit catch limits for rebuilding fish stocks and say that catch shares actually promote destructive fishing practices. [22,23]

Nutrition

Seafood contains important vitamins and minerals including vitamins A and D, phosphorus, magnesium, and selenium. Hospitals serve fish as a lean alternative to other protein sources, and value the omega-3 fatty acids that have health benefits, such as improved infant brain development and protection against heart disease and stroke.[24] However, the nutritional quality of farmed and wild fish differs. For example farmed tilapia is fed pellets made from (often genetically modified) corn and soy, and as a result they are low in Omega 3s compared to their wild counterparts. The 2015 Dietary Guidelines Advisory Committee discourages the consumption of exclusively farm-raised fish for those who want to gain the full nutritional benefits of fish, especially omega-3 fatty acids. Certain species of farmed fish such as bass, cod, trout and salmon, have equal or greater levels of omega 3's compared to their wild counterparts.[25] However, this may depend on the feed given at a particular farm.



What about chemical contamination in my fish?

Mercury emissions have fallen by 65 percent in the US over the past two decades. Unfortunately, mercury is very persistent in the environment and still remains harmful, especially in larger fish. Farmed fish is not necessarily less risky.

The Dietary Guidelines Advisory Committee holds that the risks associated with fish consumption are outweighed by the nutritional benefits of eating fish. The biggest public health concern today is the impact of contamination on fetuses and infants. Exposure can result in impaired neurological development. The FDA recommends that pregnant women, infants, and young children limit their fish consumption to 2-3 servings/ week and avoid certain species.

Aquaculture and the Environment

As wild fish stocks have become depleted or, in many cases, have completely collapsed,[26,27] the aquaculture industry has grown considerably to compensate for the growing demand and the otherwise lagging supply.[28] This shift has occurred very quickly. It is estimated that aquaculture could soon account for close to 40 percent of total seafood production globally (by weight); this is a stark change from four percent in 1970.[29] Aquaculture includes both fish and shellfish. Notably, the US only produces one percent of the global supply of aquaculture (in USD);[30] however, half of the fish that the US imports and consumes is raised through aquaculture.[31] This shift has come because of the lower prices on imported aquaculture, but it threatens local food security and rarely protects wild stocks as claimed.[32,33] Aquaculture also poses significant concerns. Major ones include:[34]

Escapes: The virtually inevitable escape of farmed species from aquaculture pens to the open water can be devastating for wild fish populations. They may carry diseases or compete with wild fish. Farmed Atlantic salmon, for instance, tend to be more dominant and aggressive than wild Pacific salmon. When they escape into the wild in Pacific regions they can displace some populations of native Pacific salmon, thereby changing the aquatic ecosystem and disrupting the wild fishing industry. Depending on when an escape occurs in Atlantic regions, the escaped salmon may be older and larger than resident wild salmon and outcompete them for food. They may also interbreed with wild Atlantic salmon and pollute and weaken the gene pool. A similar suite of problems may occur with shellfish, although it can be easier to avoid such difficulties with careful design of shellfish aquaculture and restricting the scale. Some shellfish aquaculture facilities are plagued with the uninvited proliferation of invasive species. This may lead to undesirable use of pesticides.

Fish waste and water quality: The large quantities of fish waste produced in intensive aquaculture production overruns waterways with nitrogen, causing overgrowth of plant life, depriving other species of oxygen, and ultimately transforming areas into regions that cannot support any aquatic life known as dead zones.

Sensitive lands and waters: In the same way that lands are deforested for agriculture, aquaculture also often occurs on sensitive lands and waters, resulting in habitat destruction. Sensitive areas can refer to areas that have particular ecological importance such as high biodiversity, or areas that serve as buffers for water quality, such as wetlands. An example of aquaculture's role in the destruction of sensitive lands can be seen in the role of shrimp farms causing the loss of over ⅓ of the world's mangrove forests - important coastal ecosystems which protect shorelines from storm surges and erosion, and are habitat for a variety of species.

Fish Feed: Fish meal/feed for fish raised in aquaculture is often produced from wild fish species and krill, and represents a highly inefficient use of our aquatic resources. Close to 28.3 million metric tons of seafood harvested in 2003 were used for purposes other than human consumption, with over half used for aquaculture. Fish meal is composed of a variety of wild fish species and thus threatens fish populations and biodiversity. Fish meal fisheries target the "forage of the sea" — the base of marine food chains — disrupting entire food webs.

Chemicals used in Aquaculture

In addition to the issues highlighted above, the impact of chemicals used in aquaculture is a topic of concern. Therapeutants, metals, disinfectants, and anesthetics all may be used in aquaculture and their impact on health has not been consistently verified. Some sources have done global meta-analyses on the levels of mercury and dioxins in aquaculture compared to wild seafood and found no significant differences.[35] Many other sources focusing particularly on salmon have found higher concentrations of PCBs, dioxins, widely banned insecticides and others in farmed compared to wild sources.[34] Shrimp farms commonly utilize pesticides in their operations such as organophosphates (neurotoxins), malachite green (a potential carcinogen), and organotin compounds (endocrine disrupters).[37] This use of chemicals in aquaculture is not limited to operations overseas. For example, a major Canadian aquaculture operator was recently sued for administering illegal pesticides that resulted in the death of hundreds of Atlantic lobsters.[38] Overall, this is a contentious area of research that requires more in depth analysis to verify that our seafood is safe and healthy.

Aquaculture and Antibiotic Resistance

An additional area of concern that is particularly relevant for health care is the role that aquaculture plays in contributing to antibiotic resistant bacteria. Antibiotic resistance is a major public health concern that the health care sector has a major stake in addressing.[39] The impact of animal agriculture on the development of antibiotic-resistant bacteria is well documented, and major health organizations and policy makers are calling for changes in animal rearing practices to curb antibiotic use.[40]

In contrast to terrestrial animal production, aquaculture in the US primarily prevents disease through the use of vaccines rather than antibiotics. Antibiotics are only used to treat existing illness rather than as a prophylactic measure. In the US, many antibiotics that are important for human health are banned for use in aquaculture.[41] Still, medically important antibiotics are used in US aquaculture for treatment of diseases that do not have a vaccine. However, in developing countries, where a significant portion of the farmed seafood we eat originates, the use of antibiotics as a preventative measure is still common, as vaccines have not replaced them.[42] As the scale and prevalence of aquaculture continues to grow worldwide to almost ½ the global catch, the use of antibiotics in fish baths and feed to prevent disease is concerning.[43,44] Even low and legal levels of antibiotic use in domestic aquaculture can contribute significantly to resistance.[45,46] This may be attributable to the fact that water provides an easy and constant medium through which antibiotics and resistant genes can disperse, increasing the impact of low levels. This is of particular concern as research shows that aquaculture's contribution to antibiotic resistance is equal to that of agriculture (see sidebar).

Antibiotic resistant bacteria in aquaculture primarily spread to humans through (1) fish consumption (2) fish handling during processing and (3) drinking water.[47] Imported products are a concern as over 90 percent of aquaculture occurs in Asia where, in many cases, there are limited regulations and enforcement of use. Veterinary drug violations have been found in seafood coming from Asia at ports in the US, EU, Canada, and Japan, with the highest rates of violations coming from Vietnam and China.[48] Monitoring and inspection of imported seafood

Do Humans Rely on the Antibiotics Used in Aquaculture?

Seventy-six percent of antibiotics commonly used in aquaculture and agriculture are of importance to human medicine and 12 percent are on the WHO's list of critically/highly important antimicrobials (Benbrook, C. M.).

Antibiotics that are used in agriculture, aquaculture and humans include:

- Aminoglycoside: Gentamicin
- Macrolides: Spiramycin, Erythromycin
- Penicillins: Amoxicillin, Ampicillin, Penicillin G
- Quinolone: Enrofloxacin,
- Sulfonamide: Sulfadimethoxine, Sulfadimidine, Sulfapyridine
- Tetracycline: Chlortetracycline, Oxytetracycline, Tetracycline
- Other: Trimethoprim

Many studies found that oxytetracycline was most commonly used in farm-raised fish ("Antibiotics in Farm-Raised Fish Evaluated"). Note that several other antibiotics are used in each distinct category.

must be improved to protect American consumers and shift the industry towards safer practices.[49]

Of the antibiotics commonly used in aquaculture and agriculture, 76 percent are important to human medicine and 12 percent are on the WHO's list of critically/highly important antimicrobials. Health care facilities can address the threat of antibiotic resistance by ensuring that the food they purchase was not produced with prophylactic and medically important antibiotics.[50] The simplest way to do this is to purchase local and domestic wild seafood.

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THIRD PARTY GUIDELINES AND CERTIFICATIONS

A number of third party guidelines and certifications have been developed to assist purchasers in buying seafood. The majority of these labels are focused on environmental impacts of fishing and aquaculture. These guidelines can help purchasers identify alternatives to species whose stocks are particularly strained, and avoid fish from aquaculture operations that are most harmful to ecosystems. Some of the most common third party certifiers are the Marine Stewardship Council, Best Aquaculture Practices, Aquaculture Stewardship Council, and the Monterey Bay Aquarium's Seafood Watch, which provides state-based consumer guidelines in the "stoplight" green, yellow, red format.

While these certifications and guidelines have had a powerful effect on moving the fishing and aquaculture industries towards more environmentally sustainable practices, some have been criticized for being tied too closely with the industries they are tasked with monitoring, and experts suggest that the certifier's standards have been compromised in the interest of collecting certification and licensing fees.[51,52] Furthermore, these certifications and guidelines often do not cover the full range of issues that are important to health care. Some do not address labor practices or levels of toxic contaminants, and none of the major certifications consider scales of operation, seafood seasonality, or support for community-based fishermen who are often the best stewards of the ocean.

CHOOSING SEAFOOD FOR YOUR FACILITY

As a large volume purchaser, your decisions can help protect our oceans and support our local fishing economies. As with many foods, seafood is tied closely to seasons and the place in which we live. Species-based guidelines, such as the red, yellow, green rating systems, and third party seafood certification programs are a good first step for making responsible purchasing decisions. However, using a place-based model allows you to go deeper in your support for fisheries and fishing communities. Health Care Without Harm recommends that health care facilities follow the same principles used for purchasing foods grown on land: buy local and seasonal from community-based producers. Buying directly from small and medium scale fishing businesses increases the potential that the seafood you serve achieves the multiple bottom lines of environmental stewardship, economic sustainability, and social considerations. Just as the US Department of Agriculture encourages us to "know your farmer," NAMA and HCWH advise you to "know your fisherman."

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REFERENCES

1 Northeast Fisheries Science Center Reference Document 11-19. 2010 Final Report on the Performance of the Northeast Multispecies (Groundfish) Fishery (May 2010 – April 2011) 2nd Edition

2 "COMMERCIAL FISHERIES STATISTICS." *Annual Landings*. NOAA Office of Science and Technology, 2013. Web. July 2015. <https://www.st.nmfs.noaa.gov/st1/commercial/landings/annual_landings.html>.

3 "Outside the US." *Fish Watch U.S. Seafood Facts*. NOAA, 3 Nov. 2013. Web. July 2015. <http://www.fishwatch.gov/wild_seafood/outside_the_us.htm>.

4 "The State of World Fisheries and Aquaculture: Opportunities and Challenges." Food and Agriculture Association of the United Nations, 2014. Web. July 2015. <http://www.fao.org/3/a-i3720e/index.html>.

5 Urbina, Ian. "'Sea Slaves': The Human Misery That Feeds Pets and Livestock." The New York Times, 26 July 2015. Web. <http://www.nytimes.com/2015/07/27/world/outlaw-ocean-thailand-fishing-sea-slaves-pets.html?_r=0>.

6 Phillip, Abby. "Nearly 550 Modern-day Slaves Were Rescued from Indonesia's Fish Trade. And That's Just the Beginning." The Washington Post, 10 Apr. 2015. Web. <http://www.washingtonpost.com/news/morning-mix/wp/2015/04/10/nearly-550-modern-day-slaves-were-rescued-from-indonesias-fish-trade-and-thats-just-the-beginning/>.

7 Irvine, Dean, Saima Mohsin, and Kocha Olarn. "Can Thai Fishing Industry Tackle Its Slavery Problem?" CNN. Cable News Network, 17 May 2015. Web. <http://www.cnn.com/2015/05/11/asia/freedom-project-thailand-fishing-slave-ships/>.

8 Urbina, Ian. "'Sea Slaves': The Human Misery That Feeds Pets and Livestock." The New York Times, 26 July 2015. Web. <http://www.nytimes.com/2015/07/27/world/outlaw-ocean-thailand-fishing-sea-slaves-pets.html?_r=0>.

9 Sifton, John. "Walmart's Human Trafficking Problem." *Human Rights Watch*. N.p., 17 Sept. 2012. Web. <http://www.hrw.org/news/2012/09/17/walmarts-human-trafficking-problem>.

10 "Briefing Paper- The Walmart Effect: Child and Worker Rights Violations at Narong Seafood, Thailand's Model Shrimp Processing Factory." International Labor Rights Forum and Warehouse Workers United, n.d. Web.

11 Urbina, Ian. "'Sea Slaves': The Human Misery That Feeds Pets and Livestock." The New York Times, 26 July 2015. Web. <http://www.nytimes.com/2015/07/27/world/outlaw-ocean-thailand-fishing-sea-slaves-pets.html?_r=0>.
"Exploitation of Cambodian Men at Sea: Facts about the Trafficking of Cambodian Men onto Thai Fishing Boats." *United Nations Inter-Agency Project on Human Trafficking (UNIAP): PHase III*. Strategic Information Response Network (SIREN) Case Analysis, 22 Apr. 2009. Web.
"Briefing Paper- The Walmart Effect: Child and Worker Rights Violations at Narong Seafood, Thailand's Model Shrimp Processing Factory." International Labor Rights Forum and Warehouse Workers United, n.d. Web.
Sifton, John. "Walmart's Human Trafficking Problem." *Human Rights Watch*. N.p., 17 Sept. 2012. Web. <http://www.hrw.org/news/2012/09/17/walmarts-human-trafficking-problem>.

12 Hossain, M.S. et al. "Impacts of shrimp farming on the coastal environment of Bangladesh and approach for management." *Reviews in Environmental Science and Bio/Technology*. 12.3 (2013): 313-332

13 "Briefing Paper- The Walmart Effect: Child and Worker Rights Violations at Narong Seafood, Thailand's Model Shrimp Processing Factory." International Labor Rights Forum and Warehouse Workers United, n.d. Web.
Sifton, John. "Walmart's Human Trafficking Problem." *Human Rights Watch*. N.p., 17 Sept. 2012. Web. <http://www.hrw.org/news/2012/09/17/walmarts-human-trafficking-problem>.

14 Urbina, Ian. "'Sea Slaves': The Human Misery That Feeds Pets and Livestock." The New York Times, 26 July 2015. Web. <http://www.nytimes.com/2015/07/27/world/outlaw-ocean-thailand-fishing-sea-slaves-pets.html?_r=0>.

15 Pitcher, Tony J., and William W. L. Cheung. "Fisheries: Hope Or Despair?" Marine pollution bulletin 74.2 (2013): 506.

16 Pramod, Ganapathiraju, et al. "Estimates of Illegal and Unreported Fish in Seafood Imports to the USA." Marine Policy 48 (2014): 102-13.

17 "Outside the US." *Fish Watch U.S. Seafood Facts*. NOAA, 3 Nov. 2013. Web. July 2015. <http://www.fishwatch.gov/wild_seafood/outside_the_us.htm>.

18 "What Is Aquaculture?" National Oceanic and Atmospheric Administration, n.d. Web. July 2015. <http://www.nmfs.noaa.gov/aquaculture/what_is_aquaculture.html>.

19 "Fishing & Farming Methods." Monterey Bay Aquarium Seafood Watch. Monterey Bay Aquarium Foundation, n.d. Web. July 2015. <http://www.seafoodwatch.org/ocean-issues/fishing-and-farming-methods>.;
Diana, James S. "Aquaculture Production and Biodiversity Conservation." Bioscience 59.1 (2009): 27-38.

20 "Fishing Gears and Methods." *Food and Agriculture Organization of the United Nations*. Fisheries and Aquaculture Department, 2015. Web. <http://www.fao.org/fishery/topic/1617/en>.

21 Pitcher, Tony J., and William W. L. Cheung. "Fisheries: Hope Or Despair?" Marine pollution bulletin 74.2 (2013): 506.

22 Rust, Susanne. "Catch shares leave fishermen reeling". The Bay Citizen. 12 March 2013. Web October, 2015. <https://www.baycitizen.org/news/environment/system-turns-us-fishing-rights-into-commodity-sque/>

23 Copes, Parzival and Charles, Anthony. "Socioeconomics of individual transferable quotas and community-based fishery management." *Agricultural and Resource Economics Review*. 33/2. October 2004 at 174-175.

24 Harvard School of Public Health Center for Health and the Global Environment. Web Speptember, 2015. <http://www.chgeharvard.org/topic/seafood-health-benefits-risks#sthash.fIT1jECe.dpuf>

25 The United States of America. U.S. Department of Health

and Human Services. Office of Disease Prevention and Health Promotion, Office of the Assistant Secretary for Health, Office of the Secretary. *Scientific Report of the 2015 Dietary Guidelines Advisory Committee*. N.p.: n.p., n.d. Part D. Chapter 5: Food Sustainability and Safety. Office of Disease Prevention and Health Promotion, 2015. Web. July 2015. <http://www.health.gov/dietaryguidelines/2015-scientific-report/10-chapter-5/>.

26 Pitcher, Tony J., and William W. L. Cheung. "Fisheries: Hope Or Despair?" Marine pollution bulletin 74.2 (2013): 506.

27 Pramod, Ganapathiraju, et al. "Estimates of Illegal and Unreported Fish in Seafood Imports to the USA." Marine Policy 48 (2014): 102-13.

28 Pitcher, Tony J., and William W. L. Cheung. "Fisheries: Hope Or Despair?" Marine pollution bulletin 74.2 (2013): 506.

29 Done, Hansa Y., and Rolf U. Halden. "Reconnaissance of 47 Antibiotics and Associated Microbial Risks in Seafood Sold in the United States." Journal of hazardous materials 282 (2015): 10-7.

30 "In the U.S." *Fish Watch U.S. Seafood Facts*. National Oceanic and Atmospheric Administration, n.d. Web. July 2015. <http://www.fishwatch.gov/farmed_seafood/in_the_us.htm>.

31 "Outside the US." *Fish Watch U.S. Seafood Facts*. NOAA, 3 Nov. 2013. Web. July 2015. <http://www.fishwatch.gov/wild_seafood/outside_the_us.htm>.

32 Naylor, RL et al. "Effect of aquaculture on world fish supplies". Nature 405, 1017-1024 (29 June 2000)

33 Ford JS, Myers RA (2008) A Global Assessment of Salmon Aquaculture Impacts on Wild Salmonids. PLoS Biol 6(2): e33. doi:10.1371/journal.pbio.0060033

34 Diana, James S. "Aquaculture Production and Biodiversity Conservation." Bioscience 59.1 (2009): 27-38.

35 The United States of America. U.S. Department of Health and Human Services. Office of Disease Prevention and Health Promotion, Office of the Assistant Secretary for Health, Office of the Secretary. *Scientific Report of the 2015 Dietary Guidelines Advisory Committee*. N.p.: n.p., n.d. Part D. Chapter 5: Food Sustainability and Safety. Office of Disease Prevention and Health Promotion, 2015. Web. July 2015. <http://www.health.gov/dietaryguidelines/2015-scientific-report/10-chapter-5/>.

36 "Other Meat Concerns: Antibiotics, Hormones and Toxins." *Meat Eater's Guide to Climate Change and Health*. Meat Eater's Guide: Report, 2011. Web. 10 Sept. 2015. <http://www.ewg.org/meateatersguide/a-meat-eaters-guide-to-climate-change-health-what-you-eat-matters/other-meat-concerns-antibiotics-hormones-and-toxins/#sthash.cOoCj315.dpuf>. Burridge, Les, et al. "Chemical use in Salmon Aquaculture: A Review of Current Practices and Possible Environmental Effects." Aquaculture 306.1 (2010): 7-23. ;

37 Suspicious Shrimp: The Health Risks of Industrialized Shrimp Production. Food and Water Watch, 2008. Web. September, 2015. <http://documents.foodandwaterwatch.org/doc/SuspiciousShrimpJune08.pdf>

38 Trotter, Bill. "Cooke Aquaculture to Pay $490,000 after Illegal Pesticides Kill Lobsters in Canada." *Bangor Daily News RSS*. N.p., 27 Apr. 2013. Web. <http://bangordailynews.com/2013/04/27/business/cooke-aquaculture-to-pay-490k-after-illegal-pesticides-kill-lobsters-in-canada/>.

39 "Expanding Antibiotic Stewardship: The Role of Health Care in Eliminating Antibiotic Overuse in Animal Agriculture | Health Care Without Harm." *Health Care Without Harm*. N.p., May 2014. Web. July 2015. <https://noharm-uscanada.org/documents/expanding-antibiotic-stewardship>.

40 "FACT SHEET: Over 150 Animal and Health Stakeholders Join White House Effort to Combat Antibiotic Resistance." The White House, 02 June 2015. Web. July 2015. <https://www.whitehouse.gov/the-press-office/2015/06/02/fact-sheet-over-150-animal-and-health-stakeholders-join-white-house-effo>.

41 Cabello, F. C. (2006), Heavy use of prophylactic antibiotics in aquaculture: a growing problem for human and animal health and for the environment. Environmental Microbiology, 8: 1137–1144. doi: 10.1111/j.1462-2920.2006.01054.x

42 Done, Hansa Y., and Rolf U. Halden. "Reconnaissance of 47 Antibiotics and Associated Microbial Risks in Seafood Sold in the United States." Journal of hazardous materials 282 (2015): 10-7.

43 Burridge, Les, et al. "Chemical use in Salmon Aquaculture: A Review of Current Practices and Possible Environmental Effects." Aquaculture 306.1 (2010): 7-23.

44 Done, Hansa Y., and Rolf U. Halden. "Reconnaissance of 47 Antibiotics and Associated Microbial Risks in Seafood Sold in the United States." Journal of hazardous materials 282 (2015): 10-7.

45 "Antibiotics in Farm-Raised Fish Evaluated." Feedstuffs 86.44 (2014): 15.

46 Done, Hansa Y., and Rolf U. Halden. "Reconnaissance of 47 Antibiotics and Associated Microbial Risks in Seafood Sold in the United States." Journal of hazardous materials 282 (2015): 10-7.

47 Done, Hansa Y., and Rolf U. Halden. "Reconnaissance of 47 Antibiotics and Associated Microbial Risks in Seafood Sold in the United States." Journal of hazardous materials 282 (2015): 10-7.17.

48 Love, David C., et al. "Veterinary Drug Residues in Seafood Inspected by the European Union, United States, Canada, and Japan from 2000 to 2009." Environmental science & technology 45.17 (2011): 7232.

49 Done, Hansa Y., and Rolf U. Halden. "Reconnaissance of 47 Antibiotics and Associated Microbial Risks in Seafood Sold in the United States." Journal of hazardous materials 282 (2015): 10-7.0–17; Done, Hansa Y., Arjun K. Venkatesan, and Rolf U. Halden. "Does the Recent Growth of Aquaculture Create Antibiotic Resistance Threats Different from those Associated with Land Animal Production in Agriculture?" The AAPS Journal 17.3 (2015): 513-24.

50 Benbrook, C. M. Antibiotic Drug Use in U.S. Aquaculture. Institute for Agriculture and Trade Policy Report, February 2002, www.iatp.org/library/antibiotics

51 "Exploitative Practices in the Global Shrimp Industry". Humanity United. Web. <https://www.motherjones.com/files/accenture_shrimp_report.pdf>

52 Zwerdling, Daniel and Williams, Margot. "Is Sustainable-Labeled Seafood Really Sustainable?" National Public Radio. Web. <http://www.npr.org/2013/02/11/171376509/is-sustainable-labeled-seafood-really-sustainable>

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A White Paper from Health Care Without Harm

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Heath Care Without Harm seeks to transform the health sector worldwide, without compromising patient safety or care, to become ecologically sustainable and a leading advocate for environmental health and justice.

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