May 8, 2015

The Honorable Sylvia Burwell
Secretary of Health and Human Services
200 Independence Avenue, SW
Washington, DC 20201

The Honorable Thomas Vilsack
Secretary of Agriculture
1400 Independence Avenue, SW
Washington, DC 20205

The opinions expressed herein are our own and do not necessarily reflect the views of The Johns Hopkins University.

Dear Secretaries Burwell and Vilsack,

The Johns Hopkins Center for a Livable Future is an interdisciplinary academic center based within the Johns Hopkins Bloomberg School of Public Health. The Center engages in research, policy analysis, education, advocacy, and other activities guided by an ecological perspective that diet, food production, the environment, and public health are interwoven elements of a complex system. We are pleased to submit a comment on the discussion of seafood sustainability and safety in the Scientific Report of the 2015 Dietary Guidelines Advisory Committee (DGAC). We appreciate the Committee's consideration of present and future availability of safe, nutritious seafood, but believe that fundamental issues central to this topic were overlooked, which led to flawed conclusions and recommendations.

As stated in the 2010 Dietary Guidelines for Americans (DGA), the document's ultimate goal is to "improve the health of our Nation's current and future generations by facilitating and promoting healthy eating and physical activity choices so that these behaviors become the norm among all individuals." Regarding seafood consumption, there is a risk that future generations will not have access to a variety of seafood due to unsustainable production practices and growing global demand for seafood.

Wild Fisheries and Sustainability Concerns
As the 2015 DGAC Report acknowledges, global wild-caught seafood harvests peaked around 1990, and currently most of the world's fisheries are fully exploited, overexploited, depleted, or recovering (FAO 2014). Certain fishing practices are particularly destructive, such as bottom trawling and dredging, which remove the majority of aquatic life and habitat in an area. These methods impact many aquatic life forms, causing major biodiversity loss in the ocean and disruption of the aquatic food web, thus impacting species we rely on for food (Simon and Dayton 2002; Pauly et al. 2002). The global wild-caught seafood supply is not expected to expand in the future, and there is serious concern that increasing demand for seafood, climate change, and other pressures may cause significant declines in the global seafood catch (Pauly et al. 2002).

Growth of Aquaculture
About half of the seafood consumed in the United States (US) and around the globe is from aquaculture (i.e., farmed seafood) (FAO 2014). Aquaculture is the fastest growing food animal sector and recently surpassed global beef production. Aquaculture production is closely linked to wild fish populations because many types of farmed fish species rely on formulated feed made with wild fish. In 2010, 16% of the global wild fish catch (14 million metric tons) was processed into fishmeal (FM) and fish oil (FO), and the majority of these products were used in aquaculture feed (Shepherd and Jackson 2013).

Aquaculture's reliance on FM and FO made mostly from small, wild fish (e.g., menhaden, anchovies, herring, sardines) is problematic as wild fish stocks continue to decline (Naylor et al. 2009; Cao et al. 2015). (Additional details regarding the relationship between the supply of FO and human nutrition are on page 3 of this comment.)

In addition to relying on wild fish as feed, some aquaculture production methods have significant public health risks. Large-scale offshore finfish aquaculture uses open nets or pens that can result in pollution from concentrated waste, chemicals, metals, uneaten feed, and veterinary drugs including antibiotics (Goldburg et al., 2001). In addition, transfer of diseases and use of certain chemicals in aquaculture operations impact nearby fish populations where commercial or recreational fishing may occur, thus impacting food safety and food security (Sapkota et al. 2008; Cole et al. 2009; Holmer 2010; Trotter and Cooke 2013). Alternatively, many aquaculture methods can be quite sustainable, including recirculating finfish farms and oyster and mussel farming operations.

Recognizing that the rapid expansion of aquaculture has been the driver behind meeting growing demand for seafood in recent decades, the 2015 DGAC considered three questions related to present and future availability of seafood (DGAC Report, Chapter 5, pg. 5):

1. What are the comparative nutrient profiles of current farm-raised versus wild-caught seafood?
2. What are the comparative contaminant levels of current farm-raised versus wild-caught seafood?
3. What is the worldwide capacity to produce farm-raised versus wild-caught seafood that is nutritious and safe for Americans?

Overall, the Committee sought to determine if relying on expanding aquaculture production to meet recommended seafood consumption levels in the US is feasible and appropriate. This is a critical area to study because two of three USDA Food Patterns used throughout the DGAC Report, if widely followed, would result in a significant increase in Americans' seafood consumption. Average seafood consumption in the US is 3.5 ounces per week (2010 DGA), and the Healthy-US and Mediterranean Food Patterns recommend eating 8 and 15 ounces of seafood per week, respectively, for the average person eating 2,000 calories per day (DGAC Report, Chapter 1, pg. 125). The seafood intake for the Healthy Vegetarian Food Pattern is zero. It is important to note that the US already has a relatively high per-capita seafood supply compared to the rest of the world (FAO 2014, pg. 65, Fig. 30).

Question 1: Comparing Nutrient Profiles

A primary consideration underlying seafood intake recommendations is consumption of two omega-3 long-chain polyunsaturated fatty acids, eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA). Moderate intake of EPA and DHA, of which seafood is the primary dietary source for humans, is associated with improved cardiovascular and neurodevelopmental outcomes (Larqué et al. 2012; Lee et al. 2009). Overall, high-trophic species (i.e., fish that are higher in the wild aquatic food chain) have higher levels of EPA and DHA compared to low-trophic species (i.e., fish that make up the base of the aquatic food web) because the fatty acids bio-accumulate up the food chain, starting with algae as the primary producer. The Committee reviewed data from the US Department of Agriculture on species commonly consumed in the US and found that, in general, high-trophic farmed fish species contained similar or higher levels of EPA and DHA compared to their wild counterparts, and low-trophic farmed fish species contained lower levels than the same wild fish. The Committee concluded that Americans should consume high-trophic species when choosing farmed seafood, and that feeds for low trophic species should be altered to increase levels of EPA and DHA.

Question 2: Comparing Contaminant Profiles

Regarding contaminants, the Committee relied on a joint report by the United Nations Food and Agriculture Organization (FAO) and the World Health Organization (WHO) on risks and benefits of

seafood consumption (FAO WHO 2010). According to the FAO-WHO report, the levels of mercury and persistent organic pollutants in commercially available wild and farmed seafood do not pose health risks that outweigh the health benefits of moderate seafood consumption. The DGAC agreed with the conclusions in the FAO-WHO report. The Committee also recognized the importance of i) advising pregnant and breastfeeding women to avoid species known to have higher levels of contaminants, ii) ensuring local fishers follow advisories, and iii) reassessing contaminant levels since they can change.

Question 3: Assessing Global Capacity to Produce Wild and Farmed Seafood
The Committee reviewed a 2012 UN FAO report, *The State of World Fisheries and Aquaculture*, to examine global capacity to produce wild and farmed seafood. The Committee concluded that wild fisheries need to be carefully managed to avoid collapse and that the global wild catch will not expand. Based on the trends in aquaculture production in the FAO report, the DGAC determined that output of farmed seafood will continue to grow to meet demand, and that if the global seafood supply was evenly distributed, Americans' could meet the 8 ounces per week recommended level of consumption. The Committee recommended "policy, research, and stewardship support" to promote and maintain environmental sustainability of the aquaculture industry, and suggested that aquaculture favor EPA- and DHA-rich species and low-trophic level species with nutrient densities similar to those found among wild-caught species.

Reconciling DGAC Recommendations and the Limited Global Supply of Fish Oil
We applaud the Committee's efforts to advance the national discussion on sustainability in the dietary guidelines, but we are concerned that the recommendation to increase consumption of high-trophic farmed fish was provided without thorough consideration of related sustainability and environmental impacts. For fish to contain high levels of EPA and DHA, it must be present in their diet, and the primary source in farmed fish feed is FO. In 2010, the global supply of FO (888,000 tons) and FM was made using 14 million tons of whole, wild fish and 4.6 million tons of fish by-products (i.e., bones, tails, guts, etc.)(Shepherd and Jackson 2013). Eighty percent of the global supply of FO was used in aquaculture feed, and 15% was used to make human dietary supplements (Shepherd and Jackson 2013). Increasing demand for high-trophic farmed fish could lead to escalating demand for small, wild fish used to make FO for aquaculture feed. Even though the DGAC report acknowledges the limits of the global wild seafood catch, it does not recognize that encouraging expanded aquaculture production of species with high levels of EPA and DHA is fundamentally linked to the global catch of forage fish used to produce FO. (This comment does not focus on the global supply of FM because alternative feed ingredients that provide equivalent nutrition are widely used in aquaculture feeds in combination with FM, but an increase in demand for FM from wild fish is also problematic.)

There are efforts underway to use the global supply of FO more efficiently and to expand the supply of feed ingredients that supply EPA and DHA. Production of FO from fish by-products is rising (Shepherd and Jackson 2013). Aquaculture producers are increasingly using vegetable oils to replace FO, which is likely the reason that the low-trophic farmed fish were found to have lower levels of EPA and DHA compared to wild fish. To address this issue, producers have started using vegetable oils during the majority of production and using FO in "finishing feeds" to give fish higher EPA and DHA content. Researchers are developing genetically modified algae, yeast, and *Camelina sativa* (an oilcrop) to produce EPA and DHA (or to produce them at higher levels) in order to continue expanding aquaculture without producing more FO (Betancor et al. 2015; Hamilton et al. 2014; Xue et al. 2013), but these products are currently produced in very small amounts.

Global Trade and Social Sustainability
Social concerns are often described as one dimension of a three-pronged approach to sustainability incorporating social, economic, and environmental factors. There are many social sustainability concerns in the global seafood supply chain, and the US must play a role in addressing these concerns. For

instance, there have been a number of documented cases of exploitative labor practices in the global shrimp industry (Bang 2014; Accenture 2013). As the second largest importer of seafood in the world (FAO 2014), the US has a responsibility to apply pressure on exporting countries to promote wild and farmed seafood production practices that are environmentally sustainable and involve fair labor practices. The DGAC report recognized the heavy reliance on imported seafood in the US, stating that about 90% of the seafood Americans eat is imported, but did not mention the role the US could play as a positive force on the global seafood supply chain.

The issues highlighted above demonstrate the importance of providing guidance above and beyond seafood nutrient profiles and contaminant levels to guide Americans to sustainable seafood choices. Consideration should also be given for vegetarians, vegans, and people who do not like or are allergic to seafood. A growing trend is to produce supplements or fortify foods with EPA and DHA using oils made from algae or wild fish (Bernstein et al., 2012).

Recommendations for the 2015 Dietary Guidelines for Americans
To ensure that seafood is available to more people today and for future generations, the 2015 Dietary Guidelines for Americans should:

1. Develop seafood consumption advice in consultation with experts in the fields of fisheries, aquaculture, and environmental health to ensure that the recommendations are realistic and achievable based on current aquatic food resources and trends;
2. Encourage Americans to choose wild-caught and farmed products that are lower on the aquatic food chain (i.e., oysters and small oily fish like sardines and herring), and refrain from recommending species that are associated with harmful fishing or farming practices (e.g., bottom trawling or dredging, large-scale near- and off-shore finfish farming);
3. Provide information to consumers on the implications of specific aquaculture and fishing practices regarding human health, ecological sustainability, and human welfare; and
4. Provide links to references and guides on wild and farmed seafood for consumers to seek additional information on this complicated topic (e.g., NOAA *FishWatch* and/or Monterey Bay Aquarium *Seafood Watch*).

Current recommendations in the 2015 DGAC Scientific Report are at odds with the Earth's capacity to provide seafood. The 2015 Dietary Guidelines for Americans should recognize the relationship between declining fisheries and rapidly expanding aquaculture production, and provide additional guidance to Americans to ensure that compliance with dietary recommendations will not threaten the future availability of seafood. For additional information to assist in clarifying the seafood consumption guidelines in the DGA, please contact Jillian Fry, PhD MPH (jfry3@jhu.edu) or Dave Love, PhD MSPH (dlove8@jhu.edu).

Sincerely,

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